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FAA NATIONAL AIRSPACE SYSTEM PLAN

ORIGINAL
COMPLETED

HEARINGS

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-SEVENTH CONGRESS
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*On assignment to Budget Committee for 97th Congress.

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FAA NATIONAL AIRSPACE SYSTEM PLAN

WEDNESDAY, APRIL 28, 1982

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Mr. GLICKMAN. Good morning. The subcommittee will begin its business today.

Last February, the subcommittee began its review of the FAA's long-range plan to upgrade and automate the air traffic control system. At that time, we were in receipt of Administrator Helms' national airspace system plan.

As the committee with jurisdiction over FAA R. & D. authorizations, we have the responsibility for approving the initial phases of this plan. And since such approval is often tantamount to overall approval, we want to be very thorough in our review.

Accordingly, we began with hearings in February on the details of Mr. Helms' plan. In general, I was very pleased with what he said. I found the plan to be a very comprehensive blueprint for action over the next 10 years. It certainly represents the best planning effort put forth by the FAA in a long time. In that regard, I want to congratulate all those at the FAA who worked so hard to make it a reality.

But now that some time has passed, and the air transportation community has had a chance to digest the plan, we want to give interested parties an opportunity to comment. For that reason, we have set aside these 2 days to hear from representatives of the major user groups, as well as others. Then, based upon this and other information, we will report a bill to authorize R. & D. expenditures for next year. The date for subcommittee markup is May 4.

We have two panels today. The first panel is Mr. Victor Kayne, with AOPA; Mr. John Ralph, Air Transport Association; and Mr. John Winant, president of the National Business Aircraft Association.

It might be useful, depending upon how you want to proceed, that you feel free to summarize your respective statements, and then perhaps to engage in some general ebb and flow, some general give and take on either some of the questions I would have, or perhaps some thoughts that you would have that you might want to share with each other. Let us go down the list as contained in the witness list, Mr. Kayne, Mr. Ralph, and Mr. Winant. Why don't you proceed and give whatever individual presentations you wish, and then we can go with the questions and answers. Without objection your entire statements, as submitted, will appear in the record.

STATEMENTS OF VICTOR J. KAYNE, SENIOR VICE PRESIDENT, TECHNICAL POLICY AND PLANS, AIRCRAFT OWNERS AND PILOTS ASSOCIATION; JOHN E. RALPH, SENIOR VICE PRESIDENT, OPERATIONS AND TECHNICAL SUPPORT, AIR TRANSPORT ASSOCIATION OF AMERICA; AND JOHN H. WINANT, PRESIDENT, NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC., ACCOMPANIED BY FRED McINTOSH, DIRECTOR OF OPERATIONAL SERVICES, NBAA, WILLIAM HORN, JR., MANAGER OF AIRSPACE/AIR TRAFFIC CONTROL SERVICES, NBAA, AND WILLIAM FLENER, CONSULTANT

Mr. Kayne. Thank you, Mr. Chairman. I will summarize and depend that the statement will be in the record.

We appreciate the opportunity to present AOPA's views on the FAA national airspace system plan. As you are aware, there are a number of bodies taking comments and soliciting views on the FAA plan. In order to maintain uniformity and avoid confusion because of the differing areas in which we have appeared, we have prepared a letter to the FAA Administrator outlining our position with regard to the plan. That letter is attached to our statement and constitutes our testimony for this hearing. I will summarize the technical portion of our position and ask that the complete statement be included in the record.

We have long recognized that the present air traffic control system lacks the necessary capacity to take care of future demands and that it is incapable of reasonable expansion. It is labor intensive and much of its existing equipment eventually must be replaced with newer state-of-the-art systems. The FAA plan addresses these problems.

The plan actually is a collection of many items, a number of which can be considered in the light that they are capable of stand-alone treatment and do not necessarily depend on each other for implementation. Implementation must be a gradual process, with flight operations being conducted over a period of 20 years with a mixture of old and new equipment. In cases such as the MLS, for example, aircraft will have to carry both the ILS and the MLS receivers in order to receive service nationwide. This places an operational as well as an economic burden on aircraft owners, be they airline or general aviation.

Most of the avionic equipment that will be necessary to operate within the system outlined in the FAA plan has not yet been developed to the stage where it can be purchased off the shelf. This includes such items as: MLS receivers, with precision DME capability; mode S, with data link and encoder; TCAS I; TCAS II; hard-copy printers for mode S and weather receivers.

The best estimate that we have been able to obtain put this at $10,000 per airplane for single equipage, no dual sets. We estimate that 200,000 general aviation aircraft will be users of the ATC system by the year 2000. This would mean a direct cost to the users of not less than $2 billion, and possibly up to $3 billion, depending on how many aircraft have dual sets of equipment. This is in addition to what the owners will pay in taxes levied to support the national airspace system plan.

The plan has some 97 programs listed. To summarize our position, we have consolidated many of these into single headings for convenience. For example, the various programs to enhance ARTS III we have lumped under a single heading of "Enhance ARTS III." Following this concept, this is what our position looks like:

En route—we support central flow control; 9020 computer replacement; sector suite concept; automated en route ATC, AERA; center consolidation; and long-range transition to mode S. In that environment, we oppose forced early implementation of mode S above 12,500 feet and forced implementation of mode S above 6,000 feet MSL.

In the Terminal area—we support enhancement of ARTS II and III; enhance TRACON BRITES; terminal hub consolidation; terminal/center integration; and close low activity towers. The plan says 30; we and GAO have both recommended 60 to be closed. We oppose in the terminal area automated airport services and wake vortex detectors. We say eliminate wing tip vortices at the source.

FLIGHT SERVICES

We support the FSS automation and consolidation; voice response; automated weather observations; and remote weather radar. We oppose the wind shear system.

GROUND-TO-AIR SYSTEMS

We support replacement of tube type equipment; TWEB, transcribe weather broadcast on NDB, which is not in the plan; and gradual implementation of mode S. We oppose TWEB, transcribed weather broadcast and weather data link on VOR, except for a long-range plan. We also oppose the MLS/PDME, which is MLS with precision distance measuring equipment, in that the plan has too much, too soon, forcing the issue. We also believe that ICAO is going to extend the protection date for the ILS, which will also take some of the heat off of MLS implementation.

AUXILIARY SYSTEMS

We support remote maintenance monitoring; a reduction of monitoring requirements, in other words not monitoring facilities for extended periods of time, that is not in the plan; we support replacement of the flight inspection jets with turboprops; and we support reduction of flight inspection hours.

OTHER AREAS

We support the 3,500-foot runways. We oppose the use of enplanements to justify airside expenditures.

This concludes my summary, Mr. Chairman. I will be happy to answer any questions.

Mr. GLICKMAN. Thank you.

I might mention that the Ways and Means Committee is marking up the tax provision of this ADAP bill this morning. Obviously it is quite relevant to what we are doing this morning.

[The prepared statement of Mr. Kayne follows:]

AOPA
AIRCRAFT OWNERS AND PILOTS ASSOCIATION
P.O. Box 5800, Washington, D.C. 20014 · TEL. (301) 654-0500 · TELEX 89-8468

STATEMENT OF VICTOR J. KAYNE
SENIOR VICE PRESIDENT, TECHNICAL POLICY AND PLANS
AIRCRAFT OWNERS AND PILOTS ASSOCIATION
Regarding the FAA National Airspace System Plan
U.S. House of Representatives
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
HONORABLE DAN GLICKMAN, CHAIRMAN
WEDNESDAY, APRIL 28, 1982

Mr. Chairman, we appreciate the opportunity to present our views on the FAA National Airspace System Plan. As you are aware, there are a number of bodies taking comments and soliciting views on the FAA Plan. In order to maintain uniformity and avoid confusion because of the differing areas in which we have appeared, we have prepared a letter to the FAA Administrator outlining our position with regard to the Plan. That letter is attached and constitutes our testimony for this hearing. I will summarize the technical portion of our position and ask that the complete statement be included in the record.

I also will be happy to answer any questions that the subcommittee may have.

AOPA
AIRCRAFT
OWNERS
AND
PILOTS
ASSOCIATION

April 12, 1982

The Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Dear Lynn:

While we have talked a number of times about the National Airspace System Plan, I have not written to you stating our position on the Plan or the related financing proposals.

I submitted a statement to the Mineta subcomittee after I was frozen out from testifying at his hearing of March 23. Vic Kayne submitted essentially the same statement to the Office of Technology Assessment during their evaluation conference of April 1-2. For your convenience, I am summarizing our position here, with a more detailed statement enclosed.

I believe that our main divergence comes with regard to the financial aspects. We oppose funding FAA operations and maintenance from the Trust Fund and we oppose a taxing level designed to produce money for O&M. We will accept an 8.5-cents-per-gallon fuel tax, provided that the money is dedicated to capital improvements for airways and airports and is not subject to raids for O&M or impoundment to make the budget situation look better.

There are several items in the National Airspace System Plan that provide services for more than just the "users" of the airspace, yet the Administration taxing plan would have the airspace users paying the total bill except for a small percentage for military use.

Another item that has not been given proper attention is the cost to the users of the avionics required to operate with the equipment in your Plan. The best estimates that we have been able to obtain put this at $10,000 per airplane for single equipage (no dual sets). Based on your figures of approximately 300,000 general aviation aircraft by the year 2000, we can estimate that

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Member: International Council of Aircraft Owner and Pilot Associations
When writing ALWAYS use your AOPA number.

200,000 of these would be users of the ATC system. This would mean a direct cost to the users of not less than $2 billion, and possibly up to $3 billion depending on how many aircraft have dual sets of equipment. This must be added to what the owners will pay in addition to taxes levied to support the National Airspace System Plan.

We support defederalization of the airport program, as outlined in the enclosed statement. This should ease the demand on the Trust Fund.

Regarding the technical aspects of the Plan, we perceive that it contains many items that may be considered as "stand alone" programs that could be implemented without dependence on the whole plan being approved. I believe that this is helpful since it makes it easier to establish priorities for individual program items in the event that the Congress does not give you the funding for the whole package. This is explored further in the enclosed statement.

The National Airspace System Plan has some 97 programs listed. To summarize our position, we have consolidated many of these into single headings for convenience. For example, the various programs to enhance ARTS III we have lumped under a single heading of "Enhance ARTS III." Following this concept, this is what our position looks like.

ENROUTE

Support -

Central flow control
9020 computer replacement
Sector suite concept
Automated en route ATC (AERA)
Center consolidation
Long-range transition to Mode S

Oppose -

Forced early implementation of Mode S above 12,500 ft.
Forced implementation of Mode S above 6,000 ft. MSL.

TERMINAL

Support -

- Enhance ARTS II and III
- Enhance TRACON BRITES
- Terminal hub consolidation
- Terminal/center integration
- Close low activity towers. Plan says 30, we recommend 60

Oppose -

- Automated airport services
- Wake vortex detectors. We say eliminate wing tip vortices at source

FLIGHT SERVICES

Support -

- FSS automation and consolidation
- Voice response
- Automated weather observations
- Remote weather radar

Oppose -

- Wind shear system

GROUND-TO-AIR SYSTEMS

Support -

- Replace tube type equipment
- TWEB on NDB (not in Plan)
- Gradual implementation of Mode S

Oppose -

- TWEB and weather data link on VOR except for long-range plan
- MLS/PDME. Plan has too much, too soon, forcing the issue. ICAO protection date may be extended.

AUXILIARY SYSTEMS

Support -

Remote maintenance monitoring
Reduce monitoring requirement (not in Plan)
Replace flight inspection jets with turboprops
Reduce flight inspection hours

OTHER

Support -

3,500 ft. runways

Oppose -

Use of enplanements to justify airside expenditures

The Plan has overtones of equipment requirements for aircraft as the "price of admission" to certain airspace. This also has been mentioned in several of the talks that you have given to various groups. I think that this is wrong and that the rules and regulations governing avionics carriage should be established as a result of the National Airspace Review. That will be the first opportunity that the "users" will have to make an input to this exercise. Unfortunately, they were not consulted with regard to the National Airspace System Plan.

The enclosed statement expands on the idea of "stand alone" programs within the Plan and on some of our other thinking.

I hope that this helps in making our position clear.

Sincerely,

John

John L. Baker
President

Enclosure

April 12, 1982

AOPA Position on FAA National Airspace System Plan

Overview

We have long recognized that the present air traffic control system lacks the necessary capacity to take care of future demands and that it is incapable of reasonable expansion. It is labor-intensive and much of its existing equipment eventually must be replaced with newer "state-of-the-art" systems. The FAA Plan addresses these problems.

The Plan actually is a collection of many items, a number of which can be considered in the light that they are capable of "stand alone" treatment and do not necessarily depend on each other for implementation. In no event could all parts of the Plan be implemented at once, even if the Congress were to authorize unlimited funding. The implementation must be a gradual process, with flight operations being conducted over a period of twenty years with a mixture of old and new equipment. In cases such as the MLS, for example, aircraft will have to carry both the ILS and the MLS receivers in order to receive service nationwide. This places an operational as well as an economic burden on the aircraft owners, be they airline or general aviation.

This also brings in the fact that while some estimates of the cost of the ground system have been made by the FAA, we have not yet been able to determine the cost of equipping the air fleet. However, best estimates available at this time indicate that a single set of the equipment listed in the next paragraph will cost about $10,000, installed.

Most of the avionic equipment that will be necessary to operate within the system outlined in the FAA Plan has not yet been developed to the stage where it can be purchased off the shelf from a manufacturer or dealer. This includes such items as:

MLS receivers (with Precision DME capability)
Mode S (with data link and encoder)
TCAS I
TCAS II
Hard copy printers for Mode S and weather receivers.

While the Plan purports to have only the equipment requirements, which are to be matched later with the operational and regulatory requirements developed in the National Airspace Review, the equipment Plan does contain statements that specific equipment will be required if the aircraft operator wants to receive certain services or fly in some airspace. This then fixes the equipment as the "price of admission" for that airspace or those services. This prejudges what should be determined in the National Airspace Review, which has not yet started and which will take 42 months to complete.

Demand on the System

The Plan cites increases in air carrier enplanements in reference to the demands on the system. The system in this case is dealing with airside equipments and the use of passenger enplanements is not a valid measure of air activity and aeronautical demand. Enplanements might be a valid measure in speaking of landside requirements such as pay telephones or toilets in the terminal building, but certainly not in terms of landings and takeoffs of aircraft. We recommend that "enplanements" be dropped as a justification for airside improvements and that more meaningful "operations" be used instead.

The share of landings and takeoffs at airports with FAA towers is 15% air carrier, 7% air taxi, 74% general aviation and 4% military. However, 71% of general aviation operations occur at airports that do not have a tower. Of the 432 airports with an FAA tower, most are justified by the air carrier and air taxi count of operations. Only 54 could justify a tower based on general aviation operations alone according to present criteria.

In looking at how each segment operates, we find that the airlines operate 96 percent of their flights IFR, air taxi operators fly 55% of their flights IFR, the military percentage is 18% and that under normal conditions, general aviation operates just 5% of their flights under the instrument flight rules. This places the demand in true perspective, when coupled with the average flight times. The average time per flight (VFR and IFR) for air carrier is 1:23, air taxi :29, military :32 and general aviation :31. Thus the air carriers are in the system longer, traversing more sectors and facilities. They are up and down a lot -- not every flight is transcontinental. This translates into work load on the system.

There is at the present time a temporary condition that will last until the ATC system recovers fully from the strike. General aviation flights are prohibited from filing IFR while in the air. This means that a pilot who could initiate a flight VFR and then file IFR only if questionable weather deteriorated, now has no choice but to file IFR for the whole flight even though it may end up being conducted completely in good weather. This is inflating the IFR work load unnecessarily.

Flight Service Systems

The need for modernization of the flight service system has been recognized for more than 15 years. Various plans have been developed and some even approved by the FAA many years ago. However, because of changes in policy, OMB constraints and seemingly never-ending R&D, we still do not have a modernized system. It is just getting under way and is included as a part of the Plan.

The importance of the flight service system may be emphasized when we consider that this is the source of weather information for general aviation operations. Statistics provided by the National Transportation Safety Board show that weather is a factor in 40% of all fatal general aviation accidents. Thus, lives depend on the availability of good weather information for both preflight planning and in-flight safety.

These same weather observations are the foundation for weather reports carried by TV and radio stations for the farmer, the housewife who wants to hang out her laundry, the builder, and the general public. They also play a large part in the meteorological calculations of the airlines and the military.

The flight service stations provide many other services than those for general aviation. These include handling FAA administrative messages, accident notifications, Notices to Airmen, operation of the weather teletype circuits for the National Weather Service, monitoring of navigation aids used by all who fly, search and rescue operational messages, weather observations for NWS and, in some cases, operation of airport lighting systems.

The Plan calls for automated weather observations. We approve of this concept and have been urging it for some time, particularly at locations where manned observations are not available either at all or for the full 24 hours. The FAA Plan calls for AWOS, but we believe that a less sophisticated system, called ALWOS, can do the job for less.

The Plan calls for automated weather broadcasts over the VOR voice channel and with provision for a printout or CRT in the cockpit. While this concept is desirable for the future, we have a more pressing need right now for the Transcribed Weather Broadcast (TWEB) system to be reestablished over a network of low-frequency nondirectional beacons. These provide coverage over all terrain, rather than at line-of-sight as do the VOR stations. The TWEB/NDB broadcasts can be heard in the outlying areas on the ground with a low-cost portable receiver and are a valuable aid for preflight planning. The number of NDBs shown in the FAA Plan probably is adequate to provide this coverage, lacking only the upgrading and installation of additional transcribing systems to make the automatic broadcasts feasible. This also relieves the FSS from many calls for information that should be available on the TWEB.

The completion of the FSS modernization should receive top priority from the FAA in view of its safety aspects. It can be done independently of the rest of the Plan. This also applies to the automated weather observations and the Transcribed Weather Broadcasts on nondirectional beacons.

Wind shear detection and alert systems are included in the Flight Service Chapter of the Plan, although the wording is such that they would be more applicable to the Terminal Chapter. However, the justification for these programs for general aviation is questionable and we do not support these programs.

Airports

The Plan refers to the National Airport System Plan, which also bears the acronym "NASP." We have testified many times before the Congress that the National Airport System Plan should include all public-use airports, regardless of whether they are publicly or privately owned. They all contribute to the capacity of our airport system. Currently, the National Airport System Plan is used to constrain the number of airports eligible for grants-in-aid rather than to encourage retention and improvement of all existing public-use airports. This should be rectified.

Mr. Helms has talked about his plans for short runways (3,500 feet) as a means of enhancing capacity at major airports and to increase the utility of other airports. We strongly support this concept.

The short runways for airports is another "stand alone" item that is not dependent on other parts of the Plan for implementation.

Terminals

Here again we find a number of other items that can be done independently from other parts of the Plan. These include enhancement of ARTS II and ARTS III, replacement of vacuum tube BRITE I and II, and power conditioning systems.

We have made our opposition known before to the Congress and the FAA with regard to their plans for automated airport advisory services. The FAA Plan would require mandatory Mode S transponders in all aircraft at these smaller airports where this system would be installed. This is unreasonable. Further, the need for this system is questionable and the prototype system evaluated by the FAA could create dangerous situations in the opinion of our staff pilots who flew it. We recommend deletion of this item.

The Plan calls for closing of 30 control towers. Both AOPA and the General Accounting Office have called for the closing of some 60 control towers that do not meet the FAA's own criteria for operation. While the FAA temporarily closed many of these towers following the PATCO strike, they have signaled the intention to again open most of them. In fact, some have been reopened. We recommend immediate action to permanently close all that do not clearly meet the FAA criteria. Possible exception would be one or two, such as in Alaska, where the tower is necessary for operational reasons other than air traffic control.

The Plan contains Wake Vortices Detectors. We previously have made recommendations that the best approach to this problem is research by NASA to eliminate the wing tip vortices at the source by aerodynamic modification of aircraft wing tips. The use of detection systems has some impact on the handling of air traffic, especially when approaches are being made in close order and the detector suddenly gives a warning. The result is an aborted approach and disruption of the sequence. This problem needs a different approach.

We support enhancement of ARTS II and III, terminal hub consolidation, enhancement of TRACON BRITES, and terminal/center integration.

Ground-to-Air Systems

This heading includes not only communications, but also navigation systems not ordinarily thought of in this context.

The plans for remote maintenance monitoring are a part of our previous recommendations for modernization of the FSS system and have our support.

While not mentioned in the Plan, we believe that the requirements for monitoring of many facilities can be reduced and recommend that the FAA make a study to determine what savings can be effected without any appreciable impact on safety.

In general, we support the replacement of tube type equipment with state-of-the-art equipment in all categories.

Our recommendations for a network of nondirectional beacons for Transcribed Weather Broadcasts were noted above and need only the further comment that we do not agree with the Plan which says that they will be provided for navigation only.

We note that the States have been doing their part in the provision of navigational aids in that they have navaids of one type or another at some 276 airports. Included are 34 VORs, 117 NDBs and 13 DMEs. This should be encouraged.

The Plan states that the users must have Mode S with data link by 1990 to get an ATC clearance for flight above 12,500 feet MSL. By the year 2000, this would be down to 6,000 feet MSL. Currently, a transponder is required for flight above 12,500 feet, but an ATC clearance is not required for VFR flight in this airspace. While we can see the Mode S as an upgrading of the present generation of transponders, the addition of a requirement for an ATC clearance above 12,500 feet for all traffic is not acceptable at this time. Neither is the requirement for a Mode S transponder above 6,000 feet.

These are the types of rules that should be considered by the National Airspace Review. Just because the FAA plans to have surveillance coverage in this airspace is no justification for mandatory carriage of the transponder.

It is stated in the Plan that 25 kHz spaced VHF communications channels will be required by 1990 because of the "demand" for more channels. We submit that the demand for channels is going to decrease with the reduction in the number of control towers, the consolidation of facilities and the reduction of the number of sectors. Most new VHF communications equipment is coming out with 25 kHz spacing, but there is no need to force this on older aircraft that will not be involved in the ATC system other than at some tower locations.

The ambitious plans of the FAA for MLS/PDME implementation certainly need review and adjustment. They indicate 1,255 by the year 2000. While the installation would be gradual in the intervening period, it is too much, too soon. ILS must stay in place at 827 places at least until 1995. This means that both airline and general aviation aircraft must carry ILS and MLS equipment for many years until the system settles down to a single landing aid. For aircraft where the landing system is a go/no-go item, it will mean carrying four sets of gear, two each of ILS and MLS. Not all ILS-equipped aircraft have DME. Obviously, careful planning will be necessary to avoid unduly burdening aircraft owners. We believe that the ICAO protection date for ILS is going to be extended beyond the year 1995 since there are many countries that will have no use for MLS and will continue to fly ILS-equipped airliners into the U.S.

This again is a stand-alone item. It also has the distinction of being one of those where avionics are not commercially available.

We noted with interest the comments regarding the National Emergency Radio Communications System, which is a part of the nation's Defense Readiness Program. This again emphasizes that many of the features of the National Aviation System are not just for the benefit of the users, but have a distinct national interest that transcends that of the aviation users.

Other

We support replacement of the present flight inspection jet aircraft with more fuel-efficient turboprop aircraft. This is another "stand alone" item. Reduction of flight inspection hours from 27,000 to 10,000 by the year 2000 also has our support.

Funding

The Administration proposes to fund 85% of the total FAA budget from the Aviation Trust Fund. AOPA objects to this perversion of the capital improvements intent of the original architects of the Trust Fund.

The taxes that currently are being levied on aviation are not going into the Trust Fund but instead are going into the general fund and the Highway Trust Fund. This has been going on for the past 18 months.

Last year, for the first time in ten years, spending from the Aviation Trust Fund for FAA operational needs exceeded the spending for airport development. If this drain for O&M is stopped, the money in the Trust Fund will go a long way to funding needed capital improvements -- and without additional taxation at this time.

Recognizing that the Congress and the Administration have been conditioned to the idea of so-called "user charges," which are really not user charges but are excise taxes on a selected segment of the public, we would accept an 8.5-cents-per-gallon fuel tax. This, of course, must be dedicated to capital improvements and not be subject to raids for O&M or impoundment to make the budget situation look better.

Defederalization

Large amounts of money have been distributed to airports without any need being proved under the automatic entitlement formula. This kind of Federal grant program is wasteful and not in the interest of good fiscal management or goal achievement. Airport assistance should be undertaken on the basis of need. Airports that have the resources to take care of their own needs should not be draining away the Trust Fund. We support defederalization.

General

The FAA Plan is comprehensive. So comprehensive, in fact, that it appears to include every conceivable program in the FAA "wish list." However, it lacks one thing, namely, input by the "users" who are expected to pay for the system regardless of whether they want it or will use it. Not everything in the Plan is essential or wanted. Hopefully, this will be rectified by mutual action of all concerned, including the Congress.

Mr. GLICKMAN. Let us move on with Mr. Ralph.

Mr. RALPH. Thank you, Mr. Chairman.

Taking into account the fact that my entire statement will be made a part of the record, I would like to briefly highlight a few important points that are worthy of our consideration today.

First, the airlines support the FAA national airspace system plan, the Helms plan. Second, we support the reauthorization of the Airport and the Airway Development Act, including the necessary user charges with the following attributes: Keep all public use airports eligible for ADAP and continue the ban on head taxes.

In recognition of the fact that all airports will continue to be eligible for ADAP, increase the annual ADAP program accordingly, and offset this increase by funding a greater share of the total FAA budget from the general fund.

Establish passenger ticket, cargo weigh bill and international departure taxes, no higher than necessary to support approved programs and seek equity improvement in the proportionate share of air carrier and general aviation contributions.

Avoid a large trust fund surplus by requiring the expenditures be made to carry out the combined ADAP program and the Helms plan and by providing for a reduction and user tax levels if warranted.

Insure that users have ample opportunity to confer with the FAA on the technical details of the Helms plan before those details are carried out, such as many of the points that Mr. Kayne has raised.

The third major point. The Helms plan, is required now, regardless of the level of traffic growth, because of the demand for modernization and increased productivity which, in turn will lead to impressive cost avoidance and an enhanced level of safety.

Fourth, ATC modernization is for all users, not just the Government and the airlines. In 1982, the military will account for 17 percent of the load on the ATC system. When I use the phrase "load on the ATC system," what I am referring to is the number of IFR aircraft handled by the en route ARTC centers. This is a principal measurement used by both the airlines and the FAA in determining the workload on the ATC system. Air taxis and commuters accounted for 10.7 percent, the air carriers were 43.7 percent, and general aviation 28.5 percent. Today, air carriers are the single largest user category, but we are still a minority user.

Projections for 1993 indicate that the military will be about 10.6 percent of the load on the ATC system. Air taxi and commuters will be about 12.9 percent, air carriers 37 percent, and general aviation 39.4 percent. General aviation is destined to become the largest user category in the coming decade.

Fifth, the highest priority items in the Helms plan are the replacement of the mainframe ATC computer and the acquisition of a new generation systems sector suite. These two programs make up what is referred to as the advanced automation program. The Congress should insure that the highest priority is given to this advanced automation program by providing adequate funding and insulating it, to the extent possible, from short-term perturbations.

Mr. Chairman, with these highlights in mind, I am prepared to move on.

Mr. **Glickman**. Thank you, Mr. Ralph.
[The prepared statement of Mr. Ralph follows:]

STATEMENT OF JOHN E. RALPH

AIR TRANSPORT ASSOCIATION OF AMERICA

BEFORE THE

TRANSPORTATION, AVIATION AND MATERIALS SUBCOMMITTEE

OF THE

SCIENCE AND TECHNOLOGY COMMITTEE

U. S. HOUSE OF REPRESENTATIVES

ON FAA'S NATIONAL AIRSPACE SYSTEM PLAN

APRIL 28, 1982

Statement of John E. Ralph
Senior Vice President - Operations and Technical Support
Air Transport Association of America before the
House of Representatives, Committee on Science and
Technology, Subcommittee on Transportation, Aviation
and Materials, April 28, 1982

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE

My name is John E. Ralph. I am Senior Vice President, Operations and Technical Support of the Air Transport Association of America. The Association represents virtually all of the nation's scheduled air carriers. It is a pleasure to be here today to offer our views on the FAA's National Airspace System Plan (The Helms Plan) and related research and development efforts.

Summary of Airline Views

The airlines have long supported the modernization of the Air Traffic Control System (ATC) in order to reduce congestion and delays, and to insure, above all else, that the airways will be safe, reliable, and efficiently operated. We are pleased that action is being taken to meet this need.

Thus, in principle, we support the Helms Plan and commend the Administrator for his initiative and personal direction of the technical survey that led to the plan. Based upon our preliminary review, we offer the following observations:

- The airlines and other users should participate in the review and further refinement of the plan in order to insure that necessary supporting and coordinating actions will be taken in a timely way and that actions taken by the FAA are related to capabilities of the users to respond.

- While agreeing generally with the technical scope of the plan, the airlines have developed a number of detailed questions which they have given to the FAA and we will be pleased to furnish to this Committee if desired.

- While additional cost information has been provided in recent days, longer range and more complete cost estimates are needed, including projected costs to users. The plan estimates should also contain an analysis of other factors that could affect ultimate cost, such as the degree of technical risk associated with various elements of the plan and the need for further development of the concepts employed in the systems architecture. Since large projects of this kind often end up costing far more than anticipated, the possibility of substantial overruns must be considered with some idea as to how the problem will be handled should it occur.

- The system acquisition strategy is a factor, along with the technical concept and the cost estimate, that must be carefully considered if the plan is to meet its technical, cost and schedule objectives. While FAA has purchased major items of equipment for a number of years, the Helms Plan involves the acquisition of an integrated system that goes far beyond anything that FAA has attempted before. The Administrator is aware of this aspect of the matter and has established a special program office to help manage the acquisition of the ATC replacement computer. It is extremely important that this office be adequately staffed and funded, and cloaked with the necessary authority to get the job done. In addition, to help manage all of the constituent systems, the FAA is reconstituting the Aviation Systems Acquisition Review Committee under the direct supervision of the Administrator.

- Finally, there are questions as to who will pay how much of the plan's cost, a subject which we hope shall be resolved in the Congress quickly, so that FAA can move forward with this plan in a timely fashion.

With this brief summary of our views, let me turn to the discussion of several subjects of particular relevance.

Expected Growth in Aviation Activity

The airspace system plan is needed to accommodate the growth in aviation that is expected in this decade and through the planning period to the year 2000. FAA expects that:

- IFR traffic will increase 50% in the next 10 years.

- The number of air carrier aircraft will increase only modestly from the present 2,500 or so during the next 10 year period, since growth in passengers will be accommodated by larger aircraft and improved utilization. Commuter and air taxi aircraft are expected to grow at a somewhat higher rate.

- The major source of growth will be in the general aviation category. This heterogeneous grouping now totals about 200,000 aircraft and will grow to about 300,000 by 1990. Within the grouping, business aircraft, now numbering about 65,000, are expected to reach 100,000.

Attachment I, appended at the end of my statement, portrays graphically the projected increase in the numbers of aircraft that will be handled by the ATC enroute air traffic control centers.

The forecasts used by the FAA are based upon economic assumptions and models prepared by the Office of Management and Budget. Whereas in detail, there are some specific assumptions which we believe to be overly optimistic, and others somewhat pessimistic, the overall conclusion is that the FAA growth forecasts are reasonable. It is clear that there will be significant growth and it is likewise clear that the current ATC system cannot accommodate that growth.

The prior Administration, looking at this anticipated growth, suggested, to the consternation of the aviation community, that the necessary airway and airport facilities might not be available to handle such a significant increase. The Helms Plan is intended to provide the requisite airway facilities to accommodate this growth. If for no other reason, then, an expansion of the airway facilities, along the lines contemplated in the Helms Plan, is needed if the expected growth is to be accommodated.

Modernization

In addition to the need for expansion, there is a concurrent need to modernize the ATC system. The present system is based upon computers of an earlier generation that have been outmoded by more modern solid state technology and other advancements. Maintaining these computers at a satisfactory level of reliability and obtaining the necessary spare parts is becoming progressively a more difficult task with the passage of time. The 9020 ATC mainframe computers have very little growth potential and cannot accommodate higher orders of automation necessary to implement advanced enroute air traffic control programs. Even if growth in demand materialized at a slower rate than forecast, there would still be an overwhelming need for modernization.

Improved Productivity

The enlarged and modernized ATC system is also expected to be far more productive. By substituting investment in facilities for expansion of the controller work force, the FAA Administrator has estimated that perhaps 10,000 controllers could handle the job that might otherwise require a work force in excess of 25,000. Thus, the plan permits a significant avoidance of personnel costs and provides greatly increased labor productivity.

The plan also envisages other means of improved efficiency and productivity through reduction and consolidation of many present facilities. The domestic centers, for example, would be reduced from 20 to 16 and flight service stations from 317 to 61.

Additional Challenges

The National Airspace System Plan is a bold and necessary first step. The FAA must reinforce this plan by overcoming several challenges.

- ### The Management Challenge

From previous FAA testimony, it appears that the Advanced Automation Program Office is primarily focused upon the host computer, the controller sector suite and their immediate ancillary programs. We see a need for a single, comprehensive management information and reporting system and a single management control center or office that can be used by the Administrator and his Aviation System Acquisition Review Committee (ASARC).

The challenges of effectively managing such a long lasting and complex undertaking may make it necessary for the FAA to institutionalize a true systems program office with full executive authority over contract specifications, performance, schedule and budget. As the Advanced Automation Program Office matures, perhaps it could take cognizance over the entire ATC modernization program.

- ### Research, Engineering and Development (R, E&D or R&D)

It would be helpful if the FAA were to draw up and release a detailed research and development plan which supports the airspace system plan. A significant level of research and development is needed to provide the systems identified in the plan. In joint hearings before this Subcommittee and the Subcommittee on Investigations and Oversight on March 9, 1982, we identified a number of R&D programs which should be pursued, as well as those which might be curtailed in these tight budgetary times. I have included this statement for your reference at Attachment II. While we believe that Facilities, Equipment and Development (F, E&D) program items should normally be separately funded from the R, E&D program, FAA's FY-1983 budget submission includes a number of worthwhile programs in each area.

We are pleased to note that FAA has apparently decided to move ahead now on a program to reduce vertical separation above Flight Level 290 (a pressure altitude of 29,000 feet). Since the significant benefits of this program are not dependent upon the new computer we can see an early payoff in terms of increased airspace capacity.

The FAA budgeting strategy in FY-1983 included the submission of a basic FAA budget to be followed by a supplemental at a later date after the Aviation Trust Fund revenue issues are resolved by the Congress. As a result some, or all of the items we propose may very well be included somewhere in FAA's plans. In any case, the following items should be adequately funded to assure early benefits from implementation of the modernization plan.

- Expansion of Automated Enroute Air Traffic Control (AERA) Program to Evaluate Adjacent Sector Coordination and Automatic Backup Clearance Generation Capability, and to Quantify Controller Productivity Improvements;
- Voice Communication Systems Prototype;
- Operational Test and Evaluation of MODE-S (DABS) Transponder Data Link;
- Advanced Control Concepts Technology;
- NAS Central Weather Processor and Service Unit Engineering Model; and,
- Next Generation Weather Radar (NEXRAD) (FAA share of joint program).

In addition, we believe the following items should also be included in FAA's R, E&D program.

- Automated Metering and Spacing;
- Early demonstration of AERA concepts at an Air Route Traffic Control Center and accelerated implementation of those which prove advantageous;

- Increased Emphasis on ATC Human Factors Engineering as Related to Planned System Improvements; and,
- Acceleration of Demonstration of Full Microwave Landing System Capabilities in Civil Widebody Transport Aircraft.

We note that the Administration has requested additional FY-1982 funds in the amount of $16 million. We believe these funds are necessary to permit funding of work currently under way in the following areas:

- AERA Development
- Communication and Data Link Development
- Validation of Vertical Separation Measurement Technology
- Precision DME Development (Needed for MLS evaluation)
- NEXRAD Development (FAA's share of joint program)

All of these items are supportive of the National Airspace System Plan.

- Transition Planning

Careful transition planning is clearly important for both the host and the advanced sector suite computer systems and the new software. We understand that consideration is being given to a transitional role for the enhanced DARC (Direct Access Radar Channel). To change system software while still operating the air traffic control system is a major undertaking. We recommend that a comprehensive transition plan be developed which would include not only the replacement of hardware and software but also take into account the magnitude of human engineering problems which can be anticipated.

Careful transition planning is also needed for other FAA actions -- the consolidation of ATC facilities, the new communications system, incorporation of Automatic Enroute Air Traffic Control (AERA), and data link between ATC and the aircraft warrant special attention.

We are concerned about the proposed early phase-out of the Instrument Landing System (ILS). The ILS is a proven, reliable part of the national airspace system and the air transport network. We question, on economic grounds, whether or not it is a good business decision to immediately replace ILS with another system, except at locations where ILS does not perform reliably, or at other locations where ILS could not be installed due to siting problems. Users continue to invest significant funds for airborne ILS equipment. There is a heavy investment being made to upgrade approach and landing capabilities to Category III operations. The users need to retain existing facilities and upgrade others to appropriate standards in order to realize a fair return on these investments.

- User Consultation

The MLS replacement program for ILS serves as a good example where close consultation and coordination will be needed between users and the FAA. As MLS is introduced, users wishing to exploit this capability will have to install new MLS receivers in their aircraft, but will have to retain their ILS capabilities as well. The MLS implementation schedule needs to be well integrated with user equipment acquisition plans. Since users will have to maintain dual capability for an extended period of time anyway, the FAA should be very circumspect about decommissioning fully capable and reliable ILS facilities for no other reason than to install MLS. While we support the implementation of MLS, we do not support the decommissioning of ILS facilities simply because a certain date appears on the calendar.

The FAA has given us one means for user consultation by creating the National Airspace Review (NAR) Advisory Group. The consultative groups of the NAR will address issues of procedures, airspace organization, and aircraft/ATC system interfaces. The first meetings of the NAR are scheduled in the near future and are expected to extend over several years.

In our view it is very appropriate for the users to be invited to participate in the further development and refinement of the national airspace system modernization plan. On the basis of Administration proposals, the major portion of the entire FAA budget will be funded by the Aviation Trust Fund which obtains its revenues from user charges. It is anticipated that fully 94 - 95 percent of the revenues which will go into the Aviation Trust Fund will come from the airline passenger ticket tax, cargo waybill tax and the international departure charges on passengers.

- Computer Replacement Schedule

The proposed schedule for the host computer appears to us to be both time consuming and expensive. The FAA plan calls for acquisition of two competitive host systems to be followed by a one year side-by-side run-off at the FAA Technical Center. The production award would be made in 1985 provided there is no schedule slippage. The present acquisition strategy seems to postpone the production commitment to such a late date that there is a risk of impeding sector suite development. While a competitive procurement is certainly necessary, it may be worth exploring alternatives to see if competition can be achieved while consuming somewhat less time.

With respect to the sector suite, the FAA portrays an R&D contract award in 1983 with a prototype demonstration in 1985 and contract award for the production model in 1986.

When one lays this schedule against the system architecture the FAA has portrayed for the advanced automation program, we see the potential for difficulties. The system architecture calls for distributed processing between the mainframe computer (host) and the sector suite. The advanced software programs will be partitioned to run in the host computers and the sector suite. Universal data busses utilizing standard protocols will allow the sector suites access to all necessary information shared with other systems. Simply speaking, these systems must enjoy the most intimate interrelationships. It also means that the host/sector suite is the critical link in the FAA modernization plan.

We believe the crucial interdependence of the host computer and the sector suite has been somewhat obscured by the fact that they have been portrayed as independently manageable subsystems. We also believe the procurement strategy of these programs is overly complicated and time consuming. We believe the new capabilities offered by the host and the sector suites may be needed earlier than implied by the plan. We believe that postponing the procurement decision for the host to such a late date creates uncertainties about the commitment to the plan. For all of these reasons, we would hope that the FAA would continue to study and refine this part of their plan.

- Funding

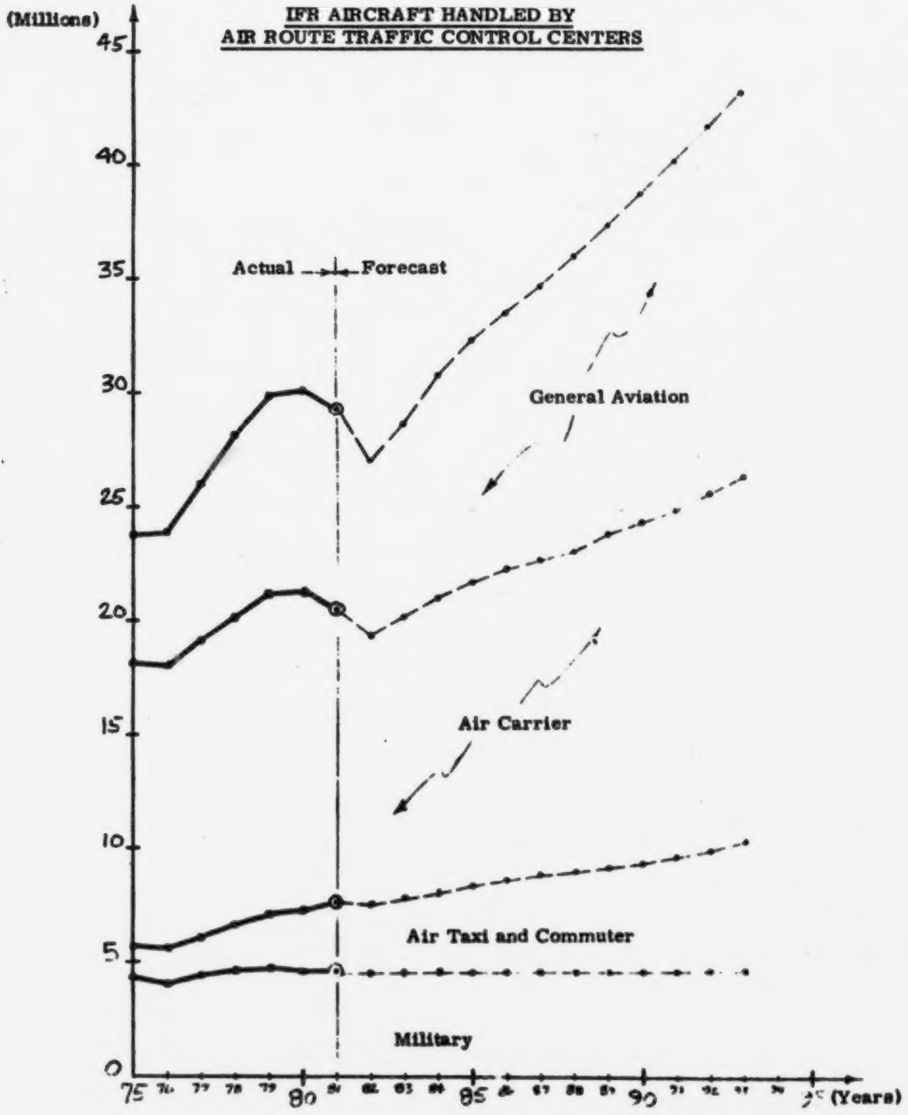
Clearly, execution of the modernization plan and its associated research and development will necessitate additional funding levels over and above what FAA has received in recent years. The airlines support the reauthorization of airport and airway legislation and the ATC modernization plan with appropriate user charges to fund approved programs. We believe the passenger ticket tax, the cargo waybill tax and the international departure charges should be no higher than necessary and should be tied to a commitment to carry out the capital improvements of the plan. If revenues exceed expenditures and an unwarranted surplus continues in the Aviation Trust Fund, provision should be made for a reduction in user tax levels. We hope the Congress will move ahead with the ATC modernization program and an adequately funded ADAP program that includes development funds for airports.

SUMMARY

In summary, Mr. Chairman, we support the FAA modernization plan in principle while reserving our right to consult with the FAA on details. We believe the ATC system must be modernized to provide the necessary capacity and efficiency of the system and to insure its continued safety in the years ahead.

This concludes my prepared statement. I am now ready for your questions.

ATTACHMENT I



IFR AIRCRAFT HANDLED BY AIR ROUTE TRAFFIC CONTROL CENTERS

Best Available Copy

ATTACHMENT II

Statement of John E. Ralph
Senior Vice President - Operations and Airports
Air Transport Association of America before
The House Committee on Science and Technology,
Subcommittee on Transportation, Aviation and Materials and
Subcommittee on Investigations and Oversight

March 9, 1982

My name is John E. Ralph. I am Senior Vice President, Operations and Airports of the Air Transport Association of America which represents virtually all of the nation's scheduled air carriers. It is a pleasure to be here today to offer our views on the important subject of research and development and air safety matters.

This nation's air transport system is widely recognized as the safest and most advanced form of public transportation in the world. We shall take every action necessary to keep it that way.

The airlines take most seriously their legal and moral responsibility to give safety the highest priority. The growth of air transportation has depended above all else on the fulfillment of these responsibilities. Airline safety and reliability have improved substantially over the years, while major advances were accomplished in terms of the number of people carried and quality of service offered. An excellent example was the introduction of transoceanic jet service. Over the past 30 years, no matter how it is measured, the safety record of scheduled airlines has improved dramatically. For example, as noted in the following statistics of the National Transportation Safety Board:

U. S. SCHEDULED DOMESTIC AND INTERNATIONAL PASSENGER SERVICE

	Fatal Accidents per Million Aircraft Miles	Passenger Fatalities per Million Aircraft Miles	Fatal Accidents per 100,000 Aircraft Departures
1951-55	0.012	0.201	0.253
1956-60	0.008	0.195	0.197
1961-65	0.006	0.148	0.160
1966-70	0.003	0.073	0.134
1971-75	0.003	0.094	0.114
1976-80	0.001	0.056	0.091

A number of actions have had a major influence on this safety record. I shall not name them all, but a few examples are in order. Certainly the new facilities in the National Aviation System and continued emphasis on training of air crews and air traffic controllers have had a major influence. Insistence upon the highest possible maintenance standards, and continued aircraft and other hardware improvements have contributed. These actions are all related in some degree to fundamental research and development (R&D) efforts. Much of the aircraft improvement was, and still is, based on the early work conducted by the National Advisory Committee on Aeronautics (NACA). The aeronautical research and technology work of NASA continues to contribute significantly. Mechanical and structural reliability of aircraft systems has been increased as a result of improved engineering and development, both by industry and Government. Turbine engines and solid state electronics development are examples where more reliable systems have contributed to the outstanding safety record of the airlines.

While today's aircraft are mechanical marvels, there will always be the goal of improvement. Real needs exist today for technological improvements. Research and development must be pursued aggressively now and in the future to achieve continuing gains. Times are changing and new areas of potential improvement need to be emphasized such as fuel conservation and increased Air Traffic Control system capacity, including reduced delays. More attention needs to be devoted to the human factors engineering part of the equation.

In our view, much of the needed R&D effort must be conducted by the Government, not only for Government operated portions of the National Airspace System, but also so that results of this research will not be confined to one segment of industry but available to all U. S. industry and Government. The alternative of private development could be prohibitively expensive, and if undertaken could result in a large part of advanced technology being proprietary to one or a few corporations and hence not generally available to all producers. Extensive Government research resources available at NASA and FAA facilities should be utilized and not duplicated by private industry.

General Concerns About Government Support of R&D

In times such as the present, when there is a need to reduce Government expenditures, we see cuts being taken or proposed in research and development funds. In our opinion, this is due, in part, to the lack of visible and measurable short-term consequences of the proposed program reduction. However, in our view, these shortsighted cuts will result in difficulties a few years later.

We respectively wish to point out three general areas of concern with respect to Government funding of R&D, specifically regarding NASA and FAA programs.

First, when it comes to aviation safety and efficiency, we do not agree that basic research should be Government, and developmental research should be private. This philosophy would imply that there is a natural break in knowledge and programs between basic and developmental research. To the contrary, the categorization of research in this way appears to create an unnatural chasm in the spectrum of knowledge. This gap is particularly apparent in high technology endeavors, and carries the risk of prematurely terminating worthwhile developments, just short of the conceptual demonstration needed to establish the development as worthy of implementation. For example, such termination of Government effort does not appear to be in the public interest in the programs for the energy efficient engine and energy efficient transport, including advance turboprop, where the results should be available to all potential producers and not be proprietary to a single firm. With regard to the advanced turboprop, we are disappointed about the Administration's plans to cancel this effort as "developmental research," and believe the plans serve as an illustration of the unnatural categorization philosophy. There are still aerodynamic and aeroelastic problems with highly swept propeller blades, and fundamental challenges exist in design of gear boxes, hubs, and blades for the high horsepower required. While other aspects of an advanced turboprop may be sufficiently mature for industry to start development, solutions to these problems are needed. Thus the knowledge about advanced turboprops spans the spectrum of basic and developmental categories. Further, if terminated now, it is unlikely that industry can overcome the risk of developing such a contribution to fuel efficiency.

Second, we are concerned that the previous FY-1982 actions relative to NASA's appropriation seem particularly paradoxical. The FY-1982 program decisions have now been confirmed in the FY-1983 budget submission. Even though Public Law 97-101 appropriated funds including $284 million for NASA aeronautical research and technology in FY-1982, the Administration has stated it expects to spend only $233 million for aeronautics, a cut taken without consultation with Congress or industry. By decimating needed programs in FY-1982, there appears to be an attempt to force Congressional actions on the FY-1983 budget before Congress has an opportunity to deliberate on the issues. While these are times of budget austerity, we do not believe that the proposed cuts to the NASA budget are fiscally sound in the long run and are not in the best interest of the nation.

The third area of concern is with respect to the FAA. Here the situation is somewhat different. The FY-1982 FAA research and development appropriation adopted by Congress reflected a radical cut from the initially proposed budget, to levels far below any discussed during public testimony. Even with the now proposed supplemental, this curtailment has reduced FAA R&D to such a low level that FAA efforts are at a virtual standstill. The projected application of selective furloughs at FAA to reduce 1982 outlays will further complicate the situation. Together, these will cause major slippages on vital programs. Further, when compared with the original FY-1982 budget request of $118.5 million ($95.0 million for R, E&D plus $23.5 million for F, E&D), the FY-1983 budget request of $133.5 million to cover both R, E&D and F, E&D projects does not appear sufficient to correct the FY-1982 funding deficiencies.

Although a different subject, we must again object about the use of Aviation Trust Fund moneys for regulatory projects and for other such items contained in the F, E&D program accounts. These are clearly inherent duties of the Government in the exercise of its police powers in the public interest, and as such should be paid for from the General Fund of the Treasury.

Specific Programs

We understand the Administration's FY-1983 budget proposes to fund, to some degree, a number of safety- and efficiency-related projects in NASA and FAA including:

- Human Factors Engineering (NASA)
- Low Speed Systems Technology (NASA)*
- High Speed Systems Technology (NASA)*
- Commercial Aircraft Fuel Savings Program (NASA)
- Wake Vortex Alleviation Investigation (NASA)
- Air Traffic Control Development (FAA)
- Advance ATC Computer Development (FAA)
- Navigation Development (FAA)
- NEXRAD - Improved Weather Radar (FAA - Joint SPO)
- Aviation Medicine (FAA)
- Aircraft Safety
  - Lights and Markings (FAA)
  - Anti-Misting Fuel (Joint NASA and FAA)
  - Cabin Materials (Joint NASA and FAA)
  - Seats (Joint NASA and FAA)
  - Math Models (Joint NASA and FAA)
  - Aircraft Icing Study (Joint NASA and FAA)
  - Snow and Ice Control Techniques (FAA)
  - Lightning Strikes (NASA)
  - Improved Tires/Runway Interface (NASA)
  - Advanced Anti-Skid Systems (NASA)
  - Better Fire Extinguishments (NASA)
  - Characterization of Atmospheric Hazards and Effects on Aircraft (NASA)
  - Lateral Gust Gradient (NASA)

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* *Congressional consideration of funding reduction of programs marked with asterisk appears appropriate.*

There are a number of additional NASA and FAA programs which the Administration is unwilling to fund that the airlines believe should be pursued aggressively. These include such items as:

NASA

- Energy Efficient Engine
- Energy Efficient Transport and Advanced Turboprop
- Large Composite Primary Aircraft Structures
- Accelerated Wake Vortex Alleviation Efforts
- Advance Head-Down Cockpit Display Comparative Evaluation
- Turbine Engine Hot Section Technology
- Accelerated Development of Data Base on Lightning Strikes
- Velocity Acceleration Heading and Altitude (VGH) Studies - Including Application to Provide Flight Technical Error Data for Use in Program to Reduce Vertical Separation
- Numerical Aerodynamic Simulator

FAA

- Mode S - Automated Traffic Advisory and Resolution System (Using ground equipment at Mode-S sensors.)
- R&D for 1,000 Feet Vertical Separation
- Acceleration of Wake Vortex Detection R&D
- Acceleration of Development of Means to Provide Controller with Aircraft/Vehicle Identity to Enhance Ground Surveillance Radar
- Low Level Wind Shear - Development and Evaluation of Ground and Airborne Alerting Systems
- Acceleration of Demonstration of Full Microwave Landing System (MLS) Capabilities in Civil Wide Body Transport

- Development of Alternative Anti-Misting Additives for Jet Fuel (In cooperation with NASA.)

In recognition of the need for budget savings, we reluctantly agree that some programs will need to be cut. Accordingly, we believe the Cockpit Display of Traffic Information (CDTI) program is of lower priority and should be reduced in scope or eliminated before those listed above. Under these circumstances, while it will probably be necessary to trim the Terminal Configured Vehicle program, we suggest consideration be given to retaining some of the facilities in the NASA inventory for selected applications. In addition, care should be exercised that the head-up display work being conducted jointly by NASA and FAA not take on the appearance of a sales pitch, but rather concentrate on improving head-up displays, and fairly evaluating their disadvantages and advantages.

We also consider that a high level of human factors engineering capability has been demonstrated at NASA's Ames Research Center, and that suggested programs to duplicate this capability at other Government facilities should be turned down unless there is convincing evidence that NASA is incapable of satisfying the requirement. It should be noted that FAA has extensive background in air traffic control which should be useful in human factors engineering for the controller and the automated Air Traffic Control system. In addition, the Aviation Safety Reporting System operated by NASA and funded by FAA provides a unique and vital data base for pilot and controller human factors; the program should continue to be operated by NASA with funding provided by either FAA or NASA.

It should also be noted that the proposed new ATC computer system promises a number of features such as improved availablity/reliability and automatic conflict free clearances. These capabilities should inherently increase safety. Continuing research and development funding for this program is of vital importance.

We are concerned, however, that a key ingredient to this new and improved system is being ignored. I refer to the lack of clear-cut statements of intent by FAA to require Mode S transponders in all aircraft. Such a requirement would help assure that the ATC system is provided with information needed to operate efficiently and safely. We see little to be gained by developing a sophisticated technical computer capability without the follow-on implementation to provide necessary inputs.

Continued acquisition of certain products of FAA R&D is also appropriate. For example, we believe that solid state Instrument Landing System (ILS) equipment should be installed to replace obsolete tube-type systems used at airports, which will remain after the conclusion of the Administration's ILS procurement program. These solid state systems utilize improved antennas and other advanced technologies developed in previous R, E&D programs. Clearly, procurement of these systems should continue.

We support FAA plans in FY-1983 to implement an improved airport surface radar, the ASDE-3, developed some time ago. We also support near-term improvements to the ATC system by providing improved tools to the controller, such as the Electronic Tabular Display System (ETABS) and Automated Metering and Spacing. In addition, new controller trainees should be introduced to new control concepts as soon as practicable during their training, so as to develop a receptiveness to the likely future changes.

Funding Commitment Needed

Finally, we believe Government research and development programs need to have some continuity and not be subject to vagaries from year to year. Programs such as NASA's Advanced Turboprop and FAA's Computer Replacement program, once initiated by the Government, should be funded to a reasonable conclusion. Consideration of a multi-year authorization for research and development in both NASA and FAA may be warranted to insure this objective. FAA's permanent authorization for procurement and implementation of airways equipment has served well in the past, and need not be adjusted at this time.

Summary

In summary, the record shows an overall improvement in airline safety, due to a great extent, in our view, to past research and development efforts, as well as airline, airways and airport improvements. While future major safety improvements may be more difficult to attain, we recommend the continued funding of the specific projects I have identified.

This completes my prepared statement, and I will endeavor to answer any questions you or the Committee may have.

Mr. GLICKMAN. Mr. Winant.

Mr. WINANT. Thank you, Mr. Chairman. I am John Winant of NBAA, which now consists of 2,624 companies which own and use aircraft of every variety to satisfy their day-to-day air transportation needs. NBAA members are, for the most part, noncommercial users of our Nation's airspace and airports and thereby have a substantial interest in the development thereof.

I have brought with me today two members of our staff, Fred McIntosh, director of operational services; and William Horn, Jr., manager of airspace/air traffic control services. Also with me today is William Flener, formerly Associate Administrator, Air Traffic and Airway Facilities, FAA, who has greatly assisted the association in its evaluation of the administration's proposal to modernize the air traffic control system. These three gentlemen, Mr. Glickman, have credentials of a technical nature far superior to mine, and I hope they may be able to participate in the discussion which ensues. I think they can add value to the record.

We would like to comment on the administration's comprehensive proposal from a technical and a management viewpoint. We also know that we should provide to the committee an examination of alternatives to be applied in the event that the national airspace system plan may be changed or delayed because of budgetary constraints. Therefore, our full statement, which we appreciate having entered in the record, is arranged in three sections: first, a technical analysis of the plan; second, alternatives in the event the plan cannot be implemented in the precise order of events specified by the administration; and third, NBAA's views on the administration's funding proposals.

In the interest of brevity, I shall, with your permission, summarize our full technical comments now in very, very brief fashion.

HOST COMPUTER

We agree with FAA's recommendation to purchase new off-the-shelf "host" computers to run the existing software pending completion of the "sector suite" concept. But we emphasize that replacement of computers must be made without derogation of full-scale operation of the ATC system. Above all, we stress as the most important single point we make in these comments that future system capacity must match future system demand. The critical role of the new computers and the new software is absolutely essential to this goal. We simply cannot afford to reach the end of this complex, comprehensive, multibillion dollar program and find we haven't matched its capabilities to the requirements of the aviation community.

DATA LINK

System users should have a clear idea of the potential benefits of this building block of the plan before they are required to purchase and install it.

REMOTE MAINTENANCE MONITORING

We favor this program, but caution that it not be used as an excuse to replace equipment before its useful life has ended.

CONSOLIDATION OF AIR ROUTE TRAFFIC CONTROL CENTERS

This proposed program, long advocated by FAA, should proceed. Consolidation should be paced so as to complement increments of new added capacity and flexibility provided by the new computers.

NEW DOT/FAA COMMUNICATIONS NETWORK

We understand in theory that improved interfacility communication will be beneficial, but we feel that the Congress and the industry need to have a much more detailed statement of planning and cost before we can make a judgment as to true worth.

DEVELOPMENT OF LONG-RANGE RADAR

FAA's proposal to upgrade primary radar capability of ARTCC's requires resolution of interests between that agency, DOD, and other Government departments.

FLIGHT SERVICE STATION MODERNIZATION

We support this program of automation and hope that longstanding political roadblocks can be removed. All users should have direct communication with the appropriate ARTCC computer, as well as a direct link to FAA's central weather processors.

SECTOR SUITES

In the knowledge that the concept will demand constant review and possible revision, we support this pivotal portion of the plan. We modulate our support only to urge close monitoring of its actual development and to advocate that the man-machine interface aspects be closely examined.

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM [TCAS]

We support the continued development of this concept.

MICROWAVE LANDING SYSTEM

NBAA believes the time has come to move ahead with implementation of MLS so users may benefit at an early date from its capacity and safety improvements.

NATIONAL AIRSPACE REVIEW [NAR]

This prodigious and demanding program is essential to whatever gains will be made in productivity. Without it, the plan cannot succeed.

ALTERNATIVES

In our review of the plan, we have looked for alternatives by which the ATC system might be upgraded in the event the plan is not adopted. Bear in mind we are recommending that the plan be adopted. But if, for some reason, that is not to be, we offer the following alternatives which would address in a limited way essential safety and capacity needs. We suggest that: One, the existing IBM 9020A's be upgraded to the latest model 9020D series.

Two, the national airspace review expedite the review and implementation of air traffic procedures that could lead to increased air traffic capacity.

Three, sector suite capability be improved by utilizing existing or updated 9020 equipment.

Four, the flight service station modernization program be continued and expedited, if possible.

Five, programs to improve the collection and dissemination of real-time aviation weather information be emphasized. High priority should be provided for the automated weather observation equipment.

Six, funding and installation of MLS continue.

Our prepared statement goes on to make points related to the funding of the system. I will defer, Mr. Glickman, any comment on them in the hope that the Ways and Means Committee today, or tomorrow morning at the latest, will enact tax levels which we feel are realistic in terms of what is actually needed to fund the programs.

Thank you very much.

[The prepared statement of Mr. Winant follows:]

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COMMITTEE ON SCIENCE AND TECHNOLOGY

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

UNITED STATES HOUSE OF REPRESENTATIVES

STATEMENT OF
NATIONAL BUSINESS AIRCRAFT ASSOCIATION (NBAA)

APRIL 28, 1982

FOR NBAA:

JOHN H. WINANT, PRESIDENT

accompanied by

FRED B. MCINTOSH, Director,
Operational Services

WILLIAM HORN, JR., Manager,
Airspace/Air Traffic Control

WILLIAM FLENER, Consultant

I am John Winant of the National Business Aircraft Association (NBAA) which now consists of 2624 companies which own and use aircraft of every variety to satisfy their day-to-day air transportation needs. NBAA members are, for the most part, non-commercial users of our nation's airspace and airports, and thereby have a substantial interest in the development thereof.

I have brought with me today two members of my staff, Fred McIntosh, Director, Operational services and William Horn, Jr., Manager, Airspace/Air Traffic Control Services. Also with me today is William Flener, formerly Associate Administrator, Air Traffic and Airway Facilities, FAA, who has greatly assisted the Association in its evaluation of the Administration's proposal to modernize the air traffic control system.

We are confronted today with the administration's new proposal for increased capital investment in facilities and equipment for development and modernization of the nation's airspace. To support that development program, which we endorse in principle, and to provide orderly planning and execution of other needed programs requires authorizing legislation that will endure for a minimum of five years. Such legislation must contain a well balanced airways and airport program and must require mandatory spending of authorized funding levels.

A decision must also be made, and fairly quickly, on the appropriations for Fiscal year 1983. Our most urgent wish is that our statement today will help this committee in making its decisions for both the long range and short term.

We would like to comment on the Administration's comprehensive new proposal from a technical and management viewpoint. We also know that we should provide to the Committee an examination of alternatives to be applied in the event that the National Airspace System Plan (the Plan) may be changed or delayed because of budgetary constraints. Therefore this statement is arranged in the following order:

A. Technical analysis of the Plan;

B. Alternatives in the event that the Plan cannot be implemented in the precise order of events specified by the Administration;

C. NBAA's views on the Administration's funding proposals.

Summary

A. TECHNICAL ANALYSIS OF THE FAA PLAN.

1. General

Mr. Helms' technical, managerial and operational credentials are superlative. His decision to move for modernization of the Air Traffic Control System (ATC) is a good and proper one. If modernization can be accomplished coincident with the rebuilding and restructuring of the existing system, it will provide through automation substantial savings for the U.S. taxpayers and potential savings might also accrue in the operation of aircraft in the system.

NBAA firmly supports the Administration's goal in developing and establishing this program. NBAA and FAA will probably have some differences of opinion on technical and operational details of the Plan, but we feel confident that these can be resolved in a constructive atmosphere.

2. Technical:

A. Host Computer

The question of precisely how and in what sequence to proceed with replacement of the hardware and the software in the ATC computer system is challenging indeed. Of the major elements of the proposed ATC computer system, the software will be the most expensive and the most demanding of time and care in preparation. The software on the existing computer is alleged to account for more of the problems with the computer than the aging IBM 9020 hardware.

We have listened to FAA's rationalization of its chosen course of action and we have listened to critics with alternate proposals. NBAA agrees that the FAA's recommendation to purchase new off-the-shelf "host" computers to run the existing 9020 software in the control centers until the new "sector suites" are developed has cost and operational advantages over other alternatives.

Two things about this computer replacement strike us as vitally important. First, the replacement must be made without derogating the full scale day-to-day operation of the ATC system. Second, we must eventually establish a capacity to match the demands which will be levied on the system in the year 2000. Many, many more airplanes must be flown safely through the air, on more efficient flight tracks. More airplanes than anyone has dreamed of. It will require great care and diligence on the part of everyone involved to insure that we do not fail in that goal.

Furthermore, the process of rehosting the existing IBM 9020 software will, in itself, tend to standardize and discipline that software, providing a relatively early improvement in efficiency and reliability.

B. Data Link

Although the Mode S data link is a building block of the Plan, cost and complexity will tend to delay implementation of the airborne transponder element of the data link particularly in the General Aviation Fleet. As a general rule, aircraft operators (including Airlines) do not invest in new airborne equipment unless or until a compensating benefit can be perceived. It would be wrong to mandate installation of an expensive version of the airborne Mode S data link before users can perceive benefits commensurate with its added cost. Mode S utilization in the proposed Traffic Alert and Collision Avoidance System (TCAS) will be addressed when TCAS is discussed later.

Voice communications to back-up any automatic data transferred over the Mode S data link will continue to exist indefinitely.

C. Remote Maintenance Monitoring

FAA has a program of remote maintenance monitoring and the plan endorses it. The concept of monitoring equipment function, stability and accuracies from a remote location has been used by industry for years. An example would be a VORTAC navigation aid remotely situated 120-miles from an airport. The proper functioning of that facility can be monitored by landlines at the FAA control tower, facility office or flight service station thus negating routine periodic visits by a technician. We stongly support this program but urge that it not be used as an excuse to replace equipment before completion of its useful life. Any replacement should be carefully analyzed for cost effectiveness.

D. Consolidation of Air Route Traffic Control Centers (ARTCC)

Reduction in the numbers of ARTCCs through consolidation has been technically feasible and operationally acceptable for many years. It's a shame it hasn't been implemented. Consolidation should be supported and encouraged, and scheduled to complement increments of capacity and flexibility provided by the new computers. Recent changes to airspace and procedures at several Centers have already resulted in substantial improvement in efficiency at a number of centers. For example, Washington ARTCC has taken over the operational control of 4 high altitude sectors previously under the control of the New York ARTCC.

E. New DOT/FAA Communications Network

FAA is proposing installation of a complex, computerized total communications network which would include other elements of the DOT family.

While we don't understand all of the complexities, we do recognize that there is a pressing need for greatly improved interfacility communications.

FAA should be requested to expand its planning and estimates so that more constructive reviews of this program can be made, both by Congress and industry.

F. Development of Long Range Radar

The plan proposes to upgrade the primary radar capability of ARTCCs. This question must be resolved between the FAA, Department of Defense and other government agencies. Utilization and planned augmentation of secondary surveillance radar (SSR) techniques could remove the need for the long range radars solely for enroute air traffic control purposes. Radar needed for other purposes should be funded by the agency whose primary interests are served.

G. Flight Service Station Modernization

NBAA, has, for years, participated in and supported automation, consolidation of Flight Service Stations. We see problems here because history has shown that political and labor lobbying influences have had more impact than technical or cost/benefit logic. However, a suitably enhanced data transfer system should enable FAA to provide all users with the capability of direct communication with the appropriate ARTCC computer, and to communicate directly with the FAA weather central processors.

H. Sector Suite

Sector suite hardware will be designed to implement an airspace management concept that would provide a small group of controllers with more available information thus enabling them to control a larger area of airspace than has been previously done. The addition of a compatible computer capability puts this controller group closer to being "managers" of their airspace rather than directly concerned with every change of course or altitude of every aircraft in their area of responsibility.

In the redesign of the new sector suite the FAA is planning to use the same suite for enroute and terminal positions. FAA also plans to consolidate into considerably fewer facilities - additional hardware will be added for the controllers use - with or without a change in his primary duties. The sector suite is one of the more costly items in the Plan. Therefore it requires considerable review and/or discussion.

Programming of the sector suite in the Plan should be supported, but this sub-committee should closely monitor the FAA's progress in development of a sector suite.

I. Traffic Alert and Collision Avoidance System (TCAS)

NBAA has long supported the need for an aircraft-derived collision avoidance and warning system and we support the continued development of TCAS. The Plan indicates that it will be a voluntary installation option for aircraft operators and is not viewed as a "price of admission" to certain airspace. The new Transponder (Mode S) will be part of the TCAS, so it can be expected that users' acceptance of data link and TCAS will further the voluntary and timely conversion to Mode S Transponders.

J. Microwave Landing System (MLS)

NBAA has participated actively in a decade of design, test, and evaluation of MLS. This new precision aid to approach and landing is proven. NBAA endorses FAA's decision to move ahead with implementation so operators can begin to benefit from capacity and safety improvements lacking in the aging Instrument Landing System(ILS).

K. National Airspace Review (NAR)

FAA has begun an extensive review of airspace procedures and regulations to ensure full benefit of the new equipment in the Plan. This review consists of over 70 meetings conducted in 16 Task Groups. It is the largest joint industry/FAA effort in the history of aviation.

The results from the NAR will be essential to achieve the ultimate gains in productivity and success of the Plan. NBAA will actively participate in this study and is committed to over 500 man-days of dedicated effort over the next 42-months.

B. ALTERNATIVES

In our review of the plan we have looked for alternatives by which the ATC system might be upgraded in the event the Plan is not adopted. Bear in mind, we are recommending that the plan be adopted, but if for some reason that is not to be, we offer the following alternatives which would address, in a limited way, essential safety and capacity needs. We suggest that:

1. the existing IBM 9020A's be upgraded to the latest model 9020D series
2. the National Airspace Review (NAR) expedite the review and implementation of air traffic procedures that could lead to increased air traffic capacity
3. sector suite capability be improved by utilizing existing or updated 9020 equipment
4. the flight service station modernization program be continued and expedited, if possible
5. Programs to improve the collection and dissemination of real-time aviation weather information be emphasized. High priority should be provided for the automated weather observation equipment.
6. Funding and installation of MLS continue.

C. THE ADMINISTRATION'S PROPOSAL FOR FUNDING THE MODERNIZATION SYSTEM

In the budget documents submitted this year, the administration states its commitment to modernizing the national airspace system, but makes such commitment subordinate to funding of 85% of all FAA programs by the civil aviation users. Since the remaining 15% is attributed to military users and other government agencies which also operate aircraft, users of the system would pay all of the costs of FAA. In fact they would pay more than 100% of the costs when charges for the use of facilities at government owned airports are added to the equation since such charges are credited to the general treasury. We strongly disagree that such a high percentage of the FAA's budget belongs to the civil users of the system and further deplore the short-sighted covetousness which led to the aviation tax proposal sent to Congress.

Every citizen has a big stake in the timely modernization of our nation's air transportation infrastructure. If the system is not modernized, our national economy will suffer. Obvious public benefits flow from the continued safe and efficient operation of our nation's airways and airport system of air commerce, and every American shares in that benefit, not just the system users. We therefore continue to urge the Congress to identify and specify the equitable share of the cost of the FAA and the National Airspace system to be borne by general tax revenues. Congress should then:

-Recognize that public interest dictates that general revenue funds should pay for at least 50 per cent of airways system operations and maintenance expense and 100 per cent of all other FAA costs.

-Establish the principle that user taxes should pay 100% of capital costs of airways system improvements, 100% of a defined national airport aid program, and for not more than 50 per cent of airways system operations and maintenance expense.

In the meantime, we should not permit the administration to back away from this important modernization plan. We urge that this committee adopt the plan and set in motion this most important capital investment program. We support the use of user-derived revenue to pay 100% of the research, development, testing, purchase and installations required to provide a well-balanced program for development, modernization and revitalization of the nation's airports and airways system. The airports program should include all of the nation's essential public-use airports, as listed in a National Airport System Plan.

We believe these improvements to be too necessary to hold them hostage to the administration's proposal to derive substantially more than 100% of the civil users share of everything else the administration wants to do in execution of its statutory and regulatory role.

Mr. GLICKMAN. Thank you all for your good testimony.

I am going to first ask you a series of questions that I would like to first ask as a general proposition. Would it be a fair statement that all of you on balance generally support the plan that Mr. Helms has put forward with the caveats that you put in your statements? That is, all of you on balance support technical modernization, computer replacement of the en route computers, some form of new collision avoidance system probably in the lines of what the Administrator has proposed? You may have some technical variances, but generally you are supportive of what he has presented; is that a fair statement?

Mr. RALPH. It is for us, yes.

Mr. WINANT. Very much so for us, yes, sir. We strongly support this program.

Mr. GLICKMAN. Mr. Kayne.

Mr. KAYNE. Yes.

Mr. GLICKMAN. The Office of Technology Assessment, which you know, is a branch of the Congress, has indicated that they believe that Mr. Helms' traffic growth forecast on which the entire plan largely depends is not accurate, at least in initial studies that I have seen from them. Their opinion is that this forecast is much too high and, therefore, this plan should be delayed or substantially scaled down. I wonder if you would have any comment on the issue of traffic? Mr. Winant?

Mr. WINANT. Mr. Glickman, I certainly do.

I cannot comment as to whether the forecasts that were originally made by FAA are absolutely correct. I don't think that the OTA can do anything but make educated projections also. I simply would make the point that we hope that the forecasts are on the high side, because we feel so strongly that when the year 2000 comes, we must have a system that is fully capable of handling the demands to be levied on it. We feel very strongly that any error in traffic forecasting should definitely be on the high side.

Mr. GLICKMAN. Mr. Kayne.

Mr. KAYNE. Thank you, Mr. Chairman. I was involved in the OTA conference on April 1 and 2 and the matter was discussed. It is true that the FAA estimates have been on the high side for quite some time. Right at the moment, we are in an area that, due to the economic situation and the aftermath of the controllers strike, trying to estimate or forecast future traffic is a rather high-risk function.

But I agree with Mr. Winant. This was brought out at the OTA conference that we are much better to have the estimates on the high side so that, if anything, we have a little excess capacity, rather than have them on the low side and then we build a system and find we do not have enough capacity. The only alternative then is to restrain traffic, and that we do not want to do. So, we would rather have the estimates a little high and be on the high side and have the capacity.

Mr. GLICKMAN. Mr. Ralph.

Mr. RALPH. When you get a group of forecasters together and you talk about long-range forecasting, first, you will have disagreements because everyone has a slightly different crystal ball and, second, the farther out you get in the future, the less certain you are about your forecasts. So, inherently, when you are talking about long-range forecasts, something in excess of 5 years, you are talking about considerable uncertainty.

Now, the FAA makes a number of forecasts. They talk about the number of aircraft that are handled by FAA towers, they make forecasts on airline enplanements, and they make forecasts on IFR traffic handled by the ATC system. This IFR traffic, I think, gets at the core of why we want a modernized ATC system.

If you go back to the late 1960's and you look at their long-range forecasts, then, the traffic growth was not as great as they had projected. However, in the early 1960's, and again in more recent years, in terms of the short-range forecasts, the FAA has had some tendency to underestimate the traffic growth in terms of IFR-controlled traffic. For example, on their forecast for IFR aircraft handled by the en route centers in 1960, their forecast was below that which was actually experienced in 1965 and 1966. Again, we have seen the same thing with their 1965 forecast which was below what was actually experienced in 1970.

Again, the major thing that we are concerned about in this modernization program is the control of IFR traffic in the airspace system. We believe that the FAA forecasts have been reasonable in that area. Sometimes they have been overestimated, but indeed sometimes they have been underestimated.

In looking at the near term, say from 1981 for the next couple of years, the PATCO strike and the current recession have caused and will continue to depress traffic. But the important thing is that traffic growth will recover, and we need enhanced safety and capacity in the timeframe in which we can accomplish the modernization. I think as a bottom line that it must be made clear that even if the traffic growth were less than forecast—and perhaps one could exaggerate to say even if it leveled off for a couple of years—we would still need modernization in order to get the productivity gains that are needed so that we can reduce the costs of providing these ATC services. And we need modernization in order to accommodate these new services which will be necessary to insure the safety of the system in the future.

So, I reject the OTA concern about whether or not a group of long-range forecasters getting together in a symposium can agree on what the long-range forecasts are going to be for the next several years.

Mr. GLICKMAN. It reminds me that forecasters are a little bit like economists, you lay all the economists in the world end to end and they never reach a conclusion. That may be true with forecasters. I guess my point is that we don't want to do something that is totally unrelated to what traffic will be. What I am trying to figure out is do you believe that the FAA has made a good-faith estimate on what traffic will be? That is all we can ask for.

Mr. RALPH. I believe they have, yes.

Mr. GLICKMAN. Your other point, I think, was that besides modernization making the system more productive, I guess if we are interested in a viable aviation system in America, a dynamic industry, both in terms of manufacturing and sales, if we don't modernize the movement of traffic from one place to the other, it could, in itself, have a bearish effect on the viability of the aviation in this country.

Mr. **Ralph**. That is correct.

Mr. **Glickman**. My next questions would relate to the costs, not so much the aggregate cost which, at this stage is probably not as relevant, but the costs with respect to your particular constituencies, the costs of compliance, both in terms of—and right now I am not so much talking about user fees or percentages on gasoline because that will basically be determined by the tax-writing committees and, hopefully, we will be able to come out with something very reasonable—but the costs of equipping airplanes.

How much of a burden do you think that is going to be on your people respectively?

Mr. **Kayne**. Mr. Chairman, for the general aviation side—and I might explain that we have a little crossover between the people I represent and Mr. Winant's constituency, in that the National Business Aircraft Association is an association you might say of companies or people who have business airplanes and, in many cases, our members are flying those same airplanes. So we do have somewhat of an overlap.

But in looking at the cost, and we have tried to cost this out to the year 2000, including things like the TCAS I, mode S, MLS receivers, and so on, and the best guess we can get, as I said in my summary, is about $10,000 per airplane for a single set of equipment, no dual equipment or backup equipment.

There are things, however, that have not yet been settled. The TCAS I, for example, for our general aviation airplanes of the less sophisticated type, the heart of that is a mode S transponder and encoder. So we will have some common equipment and, if the engineering comes out right, you can have a dual purpose piece of equipment, a mode S, if you will, with the data link and an encoder, and as an add-on, it will also have a TCAS I or collision avoidance function. If they are put separately, that runs the price up. We then duplicate the equipment.

Mr. **Glickman**. What is your estimate? Is the $10,000 figure one that you think would be for this piece of equipment that could serve two functions?

Mr. **Kayne**. No, that was based on the estimates that we got that was on a separate piece of equipment, because there is no guarantee at the moment that they are going to become available at the same time in the marketplace. That is one of the things that bothers us. People who have new equipment in their airplanes now have spent quite a bit of money on it. You have to have a good hard look at that to see if you are going to use the equipment out to its normal lifespan, because when you start replacing, for example, a present transponder with a mode S transponder, there is no resale value for the old transponder you take out. You can't trade it in like you can today. It is junk at that point. So that raises the cost of equipping, not the overall, but you get no trade-in value.

So we are taking a hard look at this and it is something that we can see that I think is going to have an adverse effect on the average general aviation owner who is right now hard put to meet the other costs, the costs of services for the airplane, mechanical services, fuel, and so on. The fuel costs—and this we have not been able to tag yet as to why—but the fuel costs, or aviation gasoline, has not gone down in the same proportion that automobile gasoline has gone down. So it is pretty expensive these days to operate a general aviation airplane.

It is true that a lot of people operate these for business and you say it is a writeoff on your income tax. But we have a lot of people who are not operating them for business, or it is half and half, for example. So the cost of the equipment comes right out of the pocket of the owner. We are somewhat concerned about this aspect, Mr. Chairman.

Mr. **Glickman**. The Administrator had estimated that the TCAS I device by itself would cost around $1,500. We have not been able to determine yet the question of how much the relevant capital equipment will cost a general aviation pilot. That would be an important figure to get pinned down at some point in time.

Mr. **Kayne**. The TCAS I—the figure that we have for the basic TCAS I is $2,500. That buys you, you might say, what we call a PWI, a proximity warning device. It merely says, "Heads up, there is an airplane in your vicinity." If you want to add on to it with a device that tells you what direction to look, whether he is ahead, behind, above or below, this runs the price of it up so that the TCAS I in jumps could go from $2,500 to $3,500 to $4,500, depending on how much you add to it. That is an example of how this goes up.

The same with the mode S. If you have what used to be called DABS, but a simple mode S transponder, you could probably have it for, say, $1,500. Don't quote me on that. I am just quoting from poor memory. If you add an encoder to it—an encoder is normally a separate function, but can be built in. That is the device that gives, of course, the altitude. Then you add the data link readout. That adds more cost in the airplane. If we then add the data link readout, if you add what it is the Brown Book, a hard copy printer or cathode ray tube readout, say, a radar screen on the airplane, this adds more to it. So the price keeps building up.

Our best estimate for the average general aviation airplane if he goes the whole route, the MLS, the mode S, the TCAS I and a readout in the airplane, $10,000.

Mr. **Glickman**. What would your best guess then be on a minimum compliance with the plan? Of course, you are assuming what the regulatory requirements would be.

Mr. **Kayne**. The only regulatory requirements that we see that might come up would be the mode S. For example, for flight—if you are talking about for anything above 6,000 feet ultimately. So a minimum on that would be, if you had no enhancement on it, $1,500 for just a straight mode S with an encoder. Now this is without the data link readout or any enhancements.

Mr. **Glickman**. OK.

Mr. Winant, do you have any comments on what Mr. Kayne said? I will give it to Mr. Ralph at the end.

Mr. **Winant**. Very good, sir. Yes, I do. I endorse the cautionary note that Mr. Kayne has raised, in terms of not building into the plan mandatory carriage of equipments so as to inhibit use of aircraft.

Let me, however, approach the question on a more general basis, if I may. I think that my constituency would answer the question in terms of weighing and then making a judgment on value received for cost incurred. I think we would come down in answering the question by stating that we think that if the plan does fulfill its promises, then the costs involved in new equipment are going to be well worth it.

Let me just give you a couple of examples. Our community for many, many years has been straining at the leash in the hope that area navigation, or RNAV as it is called, could be widely employed as a means for flight planning. There have been inhibitions on the use of RNAV, there have been misunderstandings in the air traffic control community as to how RNAV is to be employed. If the plan does result in wide-scale capability to use area navigation, then the savings to the aircraft operator will, in my judgment, outweigh any cost incurred in new equipment.

One further example: The plan should result in the capability for the aircraft operator to get direct access to the ARTCC computer for flight planning purposes, for filing flight plans. The plan also should result in the capability of every aircraft operator getting direct access through the computer to weather information. If those two objectives are achieved, and we feel they will be, then there will be benefits accruing to the operator which, again, will outweigh the cost of the equipment to be installed.

So we feel on balance and being optimistic that the plan will fulfill its objectives, that whatever costs are incurred will be greatly outweighed by the benefits received.

Mr. GLICKMAN. Mr. Ralph.

Mr. RALPH. We haven't made the kind of comprehensive examination that Mr. Kayne and his organization have made. But we have come to some generalized conclusions.

First, with respect to productivity gains that were inferred by Mr. Winant when he was talking about getting direct route flighting, the opportunity to get minimum fuel profile flights, these things are tied into the advanced automation program and what is called the AERA I part of that program.

We see the opportunity for saving literally hundreds of millions of dollars a year in fuel burn. So we see a high productivity and a high payback on the investment that the industry would make through user taxes.

That can only be done by, first, having this advanced automation, the new mainframe computers and the sector suites, and the data link is an inherent part of that, the mode S data link. We find that to be very worthwhile. So I think, on balance, we see, first, the safety enhancements in terms of collision avoidance, the productivity enhancements in terms of the AERA concepts that would be employed, as being a very worthwhile investment on which there would be substantial payback.

Mr. GLICKMAN. Now, I would like to re-ask Mr. Kayne again—you heard Mr. Winant talk generally about the benefits received should be greater than the costs incurred. What dollar amount do you think would be too much for general aviation, that is in terms of a per-airplane cost? Is $10,000 per airplane too much for perceived benefits?

I realize it is a rather general question, but I think it is one that has to be answered. The reason why is that I sense the Administrator is having—for example, as I understand he is proposing now, MLS would be mandatory to land at certain airports, TCAS would not be mandatory, mode S would be mandatory by 1990. What I am sensing is there may be some conflicting regulatory judgments that are going to be made at the FAA to maybe try to satisfy some of the users and to satisfy some of the cost situations, and you may end up with an incomplete system because of that.

So, I guess I am going to go back to the question: How much do you think general aviation can afford, and how do you deal with this question of an incomplete regulatory situation?

Mr. KAYNE. Mr. Chairman, that is a tough one.

First, general aviation covers a very broad spectrum, everywhere from the business jets down to the smallest single-engine airplane. A lot depends on how the airplanes are used, whether they are used for transportation, everyday IFR/VFR, regardless of the weather, and so on.

The FAA regulatory requirements—I think Mr. Winant touched on this very well—should come out of the national airspace review, which has not yet gotten underway. It is about to start. But that is the look at our regulatory situation, rules, procedures in the ATC system, that will govern the use of this equipment. Hopefully, the industry, with the Government, will come up with some sensible recommendations for regulations to be implemented in connection with this plan.

I hope that the FAA will adopt those recommendations. But, if they don't, then we are in for a real tough fight. As I said at the beginning of my summary, there are a number of items, despite what the FAA says, in this plan that can be considered stand-alone. You can do them all by themselves, and not touch another thing in the plan. For example, the MLS, you consider that a stand-alone. If you implement or not implement it, it is not connected to the rest of the plan, except that it is in the overall book.

The mode S could be implemented by itself to replace the present altitude recording transponder. In other words, it is an update, a state-of-the-art replacement, if you will. TCAS I and TCAS II, the new collision avoidance systems—and we have been plugging for those collectively, I guess, that is the people in these three organizations have been working together for 15 years to try to find a suitable collision avoidance system that we could all use. So the TCAS I, in our case, if it gives us some reasonable assurance of being able to avoid collisions and being able to avoid being run over, we think our members will buy this in pretty large quantities.

I cannot, however, sit here and tell you what kind of a dollar figure we are talking about. We have approached this in the past. They are buying equipment now that they pay $1,000, $1,500, $2,000 or more for, and they seem to buy it on the basis that it is going to provide them some kind of an advantage in the operation of their airplanes. But I cannot, for the life of me, sit down and tell you $10,000, $5,000 or what overall.

Plus one other point, Mr. Chairman. If we are talking, for example, of an airplane that is operating mainly VFR or, in a limited scope, IFR, we may never have a need for an MLS receiver. We have to face this on MLS. We are in an international business where airplanes are coming in from overseas, many foreign carriers who, at home, will never have a need for MLS and probably will never implement it. I think we are going to have to continue ILS service for a long time into the future. In our case where we have a choice of airports, we can go into an airport with an ILS and we would use it. If we had to go to an airport that only had MLS, we have the choice of not going there if we do not have the MLS. Therefore, we do not have to buy it and spend that money. That would cut down the cost of implementation.

Mr. GLICKMAN. OK.

Mr. Winant.

Mr. WINANT. May I just comment very briefly on that question, Mr. Chairman? It seems to me that we will not face the rather frightening prospect of ending up sometime in the future with an incomplete system. I think what we more likely will end up with is a situation whereby that aircraft operator who wants to use all elements of the system will find he has to buy all the necessary equipments. Really, that situation won't be too different from that which pertains today.

For example, in order to use the TCA's, at least the level one TCA's, today, the aircraft owner must carry an altitude recording transponder. If his choice is not to make the investment in an altitude recording transponder, he simply doesn't use that TCA airspace. So incompletion would apply to the aircraft owner who will have a choice of using most of the national airspace system if he chooses not to buy everything or, as we say in the trade, paying the full price of admission and buying all the necessary equipment and he will be entitled to use every element of that new system.

Mr. GLICKMAN. My last series of questions, I think, relate to the FAA's capability of managing the system that they are talking about now. They came out with an excellent presentation.

Mr. Ralph, I think you support in your testimony the concept of a centralized project office to manage the FAA's automation program. You also offer an excellent suggestion for the FAA to draw up a detailed R. & D. plan which supports the NAS plan. I guess I would basically ask you if you believe that they have the technical capability to manage a large system acquisition, both in terms of the new computer replacement, as well as in the other side issues here, and are they going about it in the right way?

We will start with you, Mr. Ralph.

Mr. RALPH. There is no doubt that this is going to be a major management challenge for any organization to undertake. I am sure that the Administrator understands that. He has talked about making some additions to his management team and instituting some styles of management which indicate to me that he does understand the problems that he is facing and will make the necessary adjustments in the future as they mature into this program.

But I don't think that we should assume that this will occur automatically. I think that there may need to be some prodding from the Congress and from the users. Yes, I think that, eventually, the FAA will have to create a single major program office. They need to institutionalize the management of this modernization program, which is going to take 10, 15, or 20 years. There will be changes of administration, there will be changes of Administrators, even many members of the professional civil service will be retiring over the next 20 years. So one has to institutionalize a management structure that can provide continuity and efficiency in carrying out this plan.

Now, they have the core of that, I believe, already, in terms of this advanced automation program office. I believe that a Mr. Val Hunt is in charge of that.

I don't know what the intentions of the Administrator are in terms of how he intends to expand the authorities there. Certainly that is his prerogative. But what I would see is a need for a single comprehensive management information system flowing from all of the parts of the FAA that are involved in this modernization program. One has to know what is going on in detail, and that calls for a comprehensive management reporting system and it has to come to a single management control center or management control office where the Administrator can walk in or—he has talked about revitalizing the Aviation System Acquisition Review Committee, a committee of senior associate administrators—where the senior management personnel can come in on a daily basis, or an hourly basis, and get a clear understanding of what is being done, both in terms of progress, by various contractors meeting their schedules, in terms of performance of the equipment and the software that is being acquired, and in terms of the funding streams that are involved. Then one is in the position of being able to make judgments as to where emphasis must be placed, or perhaps a reallocation of moneys and funds and resources if they run into trouble somewhere.

So I see the need for a major single management office with continuity, with a reporting system, and with access to the Administrator, and with comprehensive authority in order to make this entire program succeed.

Now, with respect to the engineering and development plan, we have heard some comments about MLS. MLS has a lot of promise. We are talking about having capabilities for a precision approach which can come in from various angles, sectored or curved approaches, approaches that have various glide path angles, as opposed to an ILS where you have a single course and a single glide path.

Perhaps MLS would help us to alleviate some of the other problems we have, like wake vortex. If we are going to bring aircraft in on different tracks, we can prevent them from the disruptions of violent turbulence as a result of other larger aircraft in front.

But to my understanding, these potentialities of MLS have not yet been fully developed and explored. I don't believe that we have had demonstrations with any commercial aircraft, or perhaps even in any general aviation aircraft, of the curved approaches and multiple glide path approaches.

So there are elements to this plan that do need additional research and development. I believe that to insure the necessary capabilities are in these equipments that are being acquired with the schedule in this plan, that you need a very comprehensive research and development plan that supports this overall modernization.

Likewise, at some point in time—and I think it is probably a little early right now—I believe the FAA should give us, give the Congress, a very comprehensive funds plan to support this modernization.

Mr. GLICKMAN. A fund plan to support the whole ball of wax?

Mr. RALPH. I don't think you could expect them to project it out for 20 years. But certainly I think we need some projections in terms of programing of about 5 years, and they ought to be able to start removing the uncertainties of the funding level as they develop this plan a little more. That is essential to us in determining the cost-benefits, the judgments that need to be made about the various bits and pieces of the plan that have been referred to.

So what this all adds up to is a need for a continuing, maturing and developing a comprehensive management structure in order to make the plan succeed. And at the core of the maturing of this management structure, I believe, is a special programs office.

Mr. GLICKMAN. Let me go back and clear up one final thing on the OTA study. OTA suggested, among other things—and I have not seen a copy of their complete report—but they suggested that we replace the 9020A's with 9020D's to gain needed capacity and then wait to modernize the en route system until the 1990's. From your testimony today, I would venture to say that you all do not support that recommendation, or is that——

Mr. RALPH. May I elaborate on that?

Mr. GLICKMAN. Sure.

Mr. RALPH. The 9020A is based upon modifications and additions of a 360/50 IBM computer. The 9020D is based upon 360/65's. Those two computers are incompatible. When you talk about upgrading a 9020A, what you are talking about is trash canning what you have got and bringing in a new 9020D complex which is based upon 360/65's. The central computer complex of an en route center requires three mainframe 360/65 type computers for the computer part of the 9020D, and about four 360/65's for the memory components of the 9020D.

Now, the 360/65 isn't being built anymore. So if you are talking about upgrading 10 of these air route traffic control sites, you are talking about going out somewhere and trying to find 70 360/65 computers. Once you have done that, you still don't have 9020D's. You have to bend metal, they require different cabling, different framing. So I think that this idea of upgrading, as the phrase has been used, 9020A's to 9020D's is really a very bad idea. First, it is going to cost you maybe on the order of $100 million. Then, what do you have? You have a system with 20-year-old technology and, within a few years, maybe 5 or 10 years, you are still going to be up against the capacity restraints that we have today, and you are going to have to throw that away and modernize again anyway.

So, I think that 9020A upgrading to 9020D is a bad idea. I don't believe it has any redeeming virtues.

Mr. GLICKMAN. Any comment by the other two panelists on that point?

Mr. KAYNE. I would like to make one comment. I was present at the OTA conference, as I said, when Barbara Corn expounded on this matter of upgrading the 9020A's to 9020D's. She made a lot of sense. I am not a computer expert. However, the way she explained it, and I read her testimony that she gave several days ago, she seemed to have a source for sufficient supply of 365/65's to modernize or upgrade the 10 locations where there are 9020A computers.

I would say for our part that we are looking at the 9020 family of computers on overall. We agree that they should be either replaced, improved, upgraded, or whatever. How this is done at the moment, I think, is going to depend on the technical expertise of people who have a heck of a lot more expertise than probably all of us at the table here. In any event, something has to be done, though, to come up with a greater capacity for those computers.

So, somewhere along the line, we are going to have to throw away something. How we get from here to there, I think, is really the big question. Ms. Corn seems to think we can do it, take the interim step for half of what the FAA projects in their plan. Frankly, I just can't say one way or the other which is the best, but I agree with what Mr. Winant said earlier, we do need to go to greater capacity. We are looking at a system now that is very limited in capacity, and something has to be done with it.

Mr. GLICKMAN. It is my understanding that one of the problems with this interim approach is that it doesn't allow for any improvements in productivity and fuel savings. It is truly an interim approach without an extraordinary amount of redeeming technological improvements. I don't know. I am no expert on it either.

I guess my big concern is do we have a technological gap here, or is the FAA's plan, Mr. Helms' plan, at the forefront of the technology?

Mr. RALPH. Wouldn't the same be true of the host computers? They are talking about replacing a 9020 with a host computer, but using the existing software. I still don't think we are going to——

Mr. GLICKMAN. I don't know the answer to the question. The FAA tells me no. When you are talking about spending the billions of dollars we are spending, I am just hopeful that we have, while we can't get all the kinks out of the armor, we have some reasonable agreement on some of these issues. I guess what worries me about it is a little bit of what Mr. Ralph said, and that is that if we are going to a more interim approach, that may be our permanent answer, that permanent approach, because of funding realities and the political realities of it. It may be time to move more aggressively.

Mr. KAYNE. And we are still going on old technology, that is the problem, as Mr. Ralph pointed out.

Mr. GLICKMAN. Mr. Winant.

Mr. WINANT. Yes, just very briefly, sir.

Where we feel that answer lies is in purchase of the new computers. We agree totally with General Ralph on that point. We do in our testimony say that, as an alternative—but certainly as an alternative only—and only if the Congress, in its own wisdom, feels that it cannot meet the requested monetary goals and requirements of the plan, then consideration should be given to upgrading. But we certainly do favor the former, and we do hope that the Congress, in its wisdom, again, will sense that this program is one of urgent need and will want to move ahead on a full-bore basis rather than a partial or second-best basis.

Mr. GLICKMAN. Yes, Mr. Kayne.

Mr. **Kayne**. Two quick comments: One, I wanted to indicate that I agree completely with Mr. Ralph's comments about a single management office for the program. In the past, we have had some experience with the proposed modernization with the flight service station systems. It has been with us almost 15 years. It has been kicked from pillar to post over in the FAA and they could never find out who knew what was going on and, by the time you got a handle on it, it slipped away and somebody else had it. So we do need this single management office, I think, for this plan.

The other point is that with MLS receivers—and I had forgotten this for a moment when you asked about it—we are talking about different grades of MLS. A small community MLS, which would give you a capability somewhat similar to the present ILS, a nonvariable glide path, a nonvariable approach course, and so on. The receiver in the airplane would likewise be simple and not sophisticated, and would cost less.

If you get into an MLS like they are talking about at Kennedy where you could have a curved approach to avoid the noise sensitive areas off the end of one runway, that takes, not only more cost on the ground, but the set in the airplane is more sophisticated and obviously more costly. So you have a variation there of what we are talking about in MLS, whether it is a simple one or a complex one.

Mr. **Glickman**. OK. I want to thank you all for your excellent testimony. I appreciate it very much.

In the next group of witnesses, we have a change. The Air Line Pilots Association will be represented by Captain Bill Cotton. We also will have Mr. William Broadwater, with the Air Traffic Control Association; and Mr. Howard E. Johannssen, president of the Professional Airways Systems Specialists.

Good morning, gentlemen. As we went through the last witnesses, it probably would be helpful if, if possible, you could summarize your testimony because your entire statement will appear in the record, and we will be able to ask some questions afterward. I would like to take the witnesses as you appear on the witness list. So it will be Captain Cotton first, Mr. Broadwater, and Mr. Johannssen. So why don't we start with you, Mr. Cotton.

STATEMENTS OF WILLIAM B. COTTON, CHAIRMAN, AIR TRAFFIC CONTROL COMMITTEE, AIR LINE PILOTS ASSOCIATION, ACCOMPANIED BY JACK HOWELL, CENTRAL AIR SAFETY CHAIRMAN, AIR LINE PILOTS ASSOCIATION, AND JOHN O'BRIEN, ENGINEERING AND AIR SAFETY DEPARTMENT, AIR LINE PILOTS ASSOCIATION; WILLIAM E. BROADWATER, AIR TRAFFIC CONTROL ASSOCIATION; AND HOWARD E. JOHANNSSEN, PRESIDENT, PROFESSIONAL AIRWAYS SYSTEMS SPECIALISTS

Mr. **Cotton**. Thank you, Mr. Chairman.

First, I would like to apologize for the absence of our president, who was unable to be here today. He is involved in negotiations between the Eastern and Braniff pilot groups as a result of the recent CAB route award.

My name is William B. Cotton, and I am chairman of the Air Traffic Control Committee of the Air Line Pilots Association, representing the professional interests of over 33,000 pilots who fly for 36 airlines. With me today are Jack Howell of Eastern Airlines, who is the ALPA executive central air safety chairman; and John O'Brien of our Engineering and Air Safety Department.

In the interest of saving time, I will not read the statement, as you have suggested, but will, instead, highlight the main points of our comments on the plan.

The ALPA position on the national airspace system plan is broadly one of support for a highly commendable effort by the agency. This support is not without qualification, however. While it fully explains the equipment requirements, the implementation goals and the support R. & D. efforts necessary for ATC system modernization, the plan does not provide a fully adequate level of detail on certain system descriptions, human performance questions associated with increased levels of automation, assumed availability of certain critical system components, and independent backup systems.

Examples of this lack of detail are found in the portions of the plan related to integrated flow management, called IFM, the Doppler weather radar system [NEXRAD], the automated en route air traffic control concept [AERA], traffic alert and collision avoidance system [TCAS], and cockpit display of traffic information. For this reason the Air Line Pilots Association cannot fully assess some technical and operational aspects of the plan.

As presented, the plan seems to imply that all efforts will flow smoothly in parallel even when the objective of one program is completely dependent on the results of other efforts. This is an ambitious as well as a necessary ingredient of the plan if the proposed implementation dates are to be met. However, this is a challenging management task, one which FAA may not be capable of undertaking.

To assure successful implementation, a total systems management approach should be employed by FAA. In the past, for various reasons, the FAA has not been able to maintain the management resources necessary to direct large-scale, complex programs from conceptual stages through full implementation. The history of the microwave landing system and collision avoidance system programs illustrates this point. For this reason, FAA should carefully consider assigning overall program management responsibility to a single contractor with support teams of FAA personnel.

Let me turn now to some of the specific provisions of the plan and comment in more detail on their role in solving the problems that we see for the air traffic control system in the years ahead.

Consolidation of certain ATC facilities and functions can obviously improve operational efficiency and reduce personnel requirements. This process started with the elimination of some center sectors as a result of the PATCO strike. Still, consolidation at some point will compromise the ability of the system to provide an adequate level of service. The controller seated in the "sector suite" must not be swamped with a myriad of data and responsibilities beyond his capabilities.

The payoff in the consolidation effort will only be realized, as we see it, if the AERA automation concept can be simultaneously implemented in an operationally acceptable form.

The plan is optimistic about the agency's ability to improve the dissemination of weather information throughout the ground system, but does not describe methods by which real-time weather will be provided to pilots in flight directly or at the pilots' request. In this regard, development of a new weather radar is essential. NEXRAD should be a priority item. Unfortunately, NEXRAD is a good example of a major program within the plan which is relatively unknown to the aviation community. The FAA should consult with the users on the operational capabilities needed in the new weather radar equipment to insure that the service needed is provided in a reasonable time and is not delayed seeking features which are not required.

FAA forecasts of aviation activity and the resultant demand on airports, even if only roughly accurate, indicate that the current airport/airway system cannot accommodate expected growth without delays averaging 30 minutes per operation during peak hours at the Nation's major airports.

Consequently, it appears that the weakest point in the plan is the program for increasing airport capacity. Resolving this problem is a major task which must be addressed. The start should be a firm commitment to seek major capacity improvements. For example, to reduce landing aircraft separation, FAA should work with NASA to find ways to reduce wake vortices, not just determine where they are. The joint use of military airports in close proximity to busy population centers should be aggressively pursued, as well as a program to provide and save many more general aviation reliever airports. In brief, the plan should contain positive commitments toward resolving the airport capacity problems. Recognizing the jurisdictions involved, the solution to this problem will require leadership from a high executive level within the administration.

Reduction in aircraft separation standards can occur only through introduction of new technology, improved accuracy of equipment, improved operating procedures, and reduction of wake vortex. Specifically, this association has for many years urged development of a means to provide a cockpit display of traffic information. This device could relieve the controller of some workload inherent in separating aircraft and could, if accurate, permit reduction in separation standards, as well as reducing "control loop" time. This does not imply that pilots desire or would accept do-it-yourself ATC. The primary separation responsibility must remain in the ground-based system. But a cockpit display of traffic information would allow pilots to accept limited, but useful, responsibilities in instrument flight conditions. Some reduction in separation might safely be achieved through the use of CDTI, and the FAA plan briefly acknowledges this without emphasis. The development and use of CDTI should be given a higher priority in the plan.

The basic objectives of AERA, automated en route air traffic control, to reduce operating costs, to accommodate traffic growth, and to increase the overall efficiency and safety of the system, can certainly be endorsed. In fact, AERA automation will be necessary if ATC manpower reductions are to be realized. However, the AERA concept, as it now exists, appears to be totally "ground oriented." It proposes to develop on the ground fuel-optimized routings, flight profiles, and severe weather-avoidance profiles, all without providing the pilot options to evaluate based on operational factors known only to him.

Concurrent with this proposed development, there will be an ever-increasing number of airborne performance and navigation computers which can better solve the optimization problem because of their location in the aircraft involved. Consequently, we feel that AERA will serve the users best by limiting itself to problems of traffic conflict and resolution.

Additionally, in an environment totally dependent on data link for communications between the pilot and the ATC system, such as in AERA, it is absolutely essential that the aircrew have the capability to validate control instructions and to retain a picture of the traffic situation within a reasonable distance of his own flight path. This capability can be provided through the cockpit display of traffic information. With implementation of AERA and dependence on automation in the ATC system, it also becomes vital that an independent backup airborne collision avoidance system be provided.

It is one basic assumption of the plan that a backup ground independent airborne separation device called TCAS will be available. While the plan describes a positive implementation strategy which mandates mode S transponders, no such provisions are described for TCAS. As Mr. Albrecht of the FAA told this committee in February:

> TCAS II will be a full-scale collision avoidance system capable of operating in high-density airspace and providing not only collision avoidance information, but also a direction-to-look for the pilot to spot conflicting aircraft.

A system which meets these basic requirements is essential to the success of the NAS plan. Therefore, the requirement to carry an FAA-described TCAS II should be mandated for air carriers to insure that the critical assumption made concerning this availability in the NAS plan is actually realized.

In summary, we feel that the national airspace system plan is basically good and should be supported. We strongly urge, however, that further consideration and refinement be given the following:

One, TCAS implementation; two, cockpit display of traffic information; three, implementation of higher levels of automation; and four, the airport capacity problems.

This concludes my statement, Mr. Chairman. We appreciate this opportunity to present ALPA's views on this important subject, and I will be pleased to answer any questions you may have.

[The prepared statement of Capt. John J. O'Donnell, president of Air Line Pilots Association, follows:]

STATEMENT OF
CAPTAIN JOHN J. O'DONNELL, PRESIDENT
AIR LINE PILOTS ASSOCIATION
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES
APRIL 28, 1982
FAA NATIONAL AIRSPACE SYSTEM PLAN

Good morning, Mr. Chairman and members of the Subcommittee. I am Captain John J. O'Donnell, President of the Air Line Pilots Association which represents the professional interests of over 33,000 pilots who fly for 36 airlines With me today are Jack Howell of Eastern Airlines who is the ALPA Central Air Safety Chairman, Bill Cotton of United Air Lines who is Chairman of the ALPA Air Traffic Control Committee and John O'Brien of our Engineering and Air Safety Department. We appreciate this opportunity to appear before you today to present the views of ALPA on the FAA'S National Airspace System Plan. Our comments today are the result of a detailed analysis by a special task force made up of seven line pilots who specialize in air traffic control matters and four ALPA professional staff members.

The National Airspace System Plan published by the FAA on January 28, 1982, is a highly commendable effort by the Agency. The Plan consolidates in one document the equipment requirements, implementation goals and the support R&D efforts necessary for airspace system modernization. However, the Plan does not provide a fully adequate level of detail on (1) certain system descriptions, (2) human performance associated with increased levels of automation, (3) assumed availability of certain critical system components and (4) independent backup systems. Examples of a lack of detail are found in the portions of the Plan related to Integrated Flow Management (IFM), Doppler Weather Radar System (NEXRAD), the Automated En Route Air Traffic Control Concept (AERA), Traffic Alert and Collision Avoidance System (TCAS), and Cockpit Display of Traffic Information (CDTI). For this reason, the Air Line Pilots Association cannot fully assess some technical and operational aspects of the Plan.

In that the U.S. National Airspace System must be a common system for all categories of users, i.e., air carrier, military and general aviation, problems must be anticipated because the Plan does not now reflect the full consensus of all civil and military interests. These various interests may well disrupt the implementation schedule; however, if FAA makes timely use of the National Airspace Review process, these potential conflicts may be overcome.

As presented, the Plan seems to imply that all efforts will flow smoothly in parallel even when the objective of one program is completely dependent on the results of other efforts. This is an ambitious as well as a necessary ingredient of the Plan if the proposed implementation dates are to be met. However, this is a challenging management task — one which FAA may not be capable of undertaking.

To assure successful implementation, a total systems management approach should be employed by FAA. In a total "systems management approach," computer hardware and software would be the responsibility of the Sector Suite Contractor and, also, implementation for all aspects of the Plan would be the responsibility of a single Executive Authority. In the past, for various reasons — not all within the control of the Administrator (elections, retirements, pay scales, etc.) — the FAA has not been able to maintain the management resources necessary to direct large scale, complex programs from conceptual stages through full implementation. The history of the Microwave Landing System (MLS) and Collision Avoidance System (CAS) programs illustrate this point. For this reason FAA should carefully consider assigning overall program management responsibility to a single contractor with support teams of FAA personnel from ATS, ATF, AS, R&D, OSEM, etc.

Let me turn now to some of the specific provisions of the Plan and comment in more detail on their implementation to solve the problems that we see for the air traffic control system in the years ahead.

Current System and Near Term (to 1985)

Unfortunately, the National Airspace System 20 Year Plan does not clarify FAA plans regarding the en route computer system. During the latter part of calendar year 1980, a Senate investigations staff conducted an examination of FAA's en route system. As a result of this study, a recommendation was made in part that "No Research, Engineering and Development funding for fiscal year 1981 be expended for the proposed replacement system pending completion of a comprehensive study and analysis by FAA to determine. . .interim actions and funding necessary to correct identified deficiencies and enhance the current system in order to extend its operational life during the replacement system acquisition cycle." Subsequent testimony provided by the FAA in June 1981 addressed improved management of the en route computer system; however, the specific results of the directed study and analysis have not been announced. What were the results? Has action been taken to ensure the availability of hardware for the planned near term enhancements? The NAS Plan should provide this information and indicate whether the current 9020 system will be satisfactory during the transition period (1982-1985) and until a new host computer is available.

ATC Facility Consolidations

Consolidation of certain ATC facilities and functions can obviously improve operational efficiency and reduce personnel requirements. This process started with the elimination of some ARTCC sectors as a result of the PATCO strike. Still, consolidation — at some point — can compromise the ability of the system to provide an adequate level of service. The needs of all system users must be addressed in implementing this phase of modernization. The controller seated in the "sector suite" must not be swamped with a myriad of data and responsibilities beyond his abilities. Human factors specialists must work with the primary users in reaching consolidation decisions.

Payoff in the consolidation effort will only be realized if the AERA automation concept can be simultaneously implemented in an operationally acceptable form.

Weather Dissemination (NEXRAD)

The Plan is optimistic about the Agency's ability to improve drastically dissemination of weather information via the ground system but does not describe methods by which real-time weather will be provided to pilots in flight. There must be a strong commitment by the FAA to provide real-time information to pilots in flight directly or at the pilot's request. Data link transmission of sequence reports alone will not satisfy this requirement. In this regard, development of a new weather radar is essential. NEXRAD should be a priority item, considering the age, operational capabilities and the maintainability of existing weather radars. Because over fifty percent of all aviation accidents are to some extent weather related, the need is unquestionable. Unfortunately, NEXRAD is a good example of a major program within the Plan which is relatively unknown to the aviation community. The FAA should consult with the users on the operational capabilities needed in the new weather radar equipment to ensure that the service needed is provided in a reasonable time and is not delayed because of research and development directed towards exotic features which are not cost effective and are not required.

The Plan suggests the eventual total automation of weather observations. While efforts to reduce manpower and labor costs are appreciated, real world and safety requirements must be recognized. The initiative to provide limited automated weather observations at some airports not now having such data available are appreciated; however, the capabilities have not yet been demonstrated which would allow automated observations to replace full time human observers at all airports. The industry investment in state-of-the-art avionics and landing systems could be compromised if the lack of real-time weather observation or the reliability of these observations became a pacing factor. Until such capabilities have been demonstrated, automated observations as the sole source of weather data at any busy air carrier airport should not be planned.

Demands on the System

FAA forecasts of aviation activity and the resultant demand on airports, even if only roughly accurate, indicate that the current airport/airway system cannot accommodate expected growth without delays of "30 minutes per operation" during peak hours at the Nation's major airports.

Consequently, it appears that the weakest point in the Plan is the program for increasing airport capacity. The Plan implies that the current capacity limitations at many hub airports are limitations anticipated for the foreseeable future. The Plan does indicate that a limited growth can be achieved through improved procedures and other related actions. This bandaid approach cannot substitute for aggressive, positive actions to improve airports dramatically over the next 20 years and to increase substantially the capacities at major airports. The FAA system modernization program must include a vigorous effort directed at the airport capacity problem. Otherwise, all the planned improvements will only result in air carriers sitting on the ground waiting for a departure time from the new system or holding "in style" while waiting for an approach time. Resolving this problem is a major task which must be addressed. The start should be a firm commitment to seek major capacity improvements. For example, to reduce landing aircraft separation, FAA should work with NASA to find ways to reduce wake vortices, not just determine where they are. The joint use of military airports in close proximity to busy population centers should be aggressively pursued as well as a program to provide many more general aviation reliever airports. In brief, the Plan should contain positive commitments toward resolving the airport capacity problems. Recognizing the jurisdictions involved, the solution to this problem will require leadership from a high executive level within the Administration.

System Capacity (Reduced Separation)

Reduction in aircraft separation standards can occur only through introduction of new technology, improved accuracy of equipment, improved operating procedures and reduction of wake vortex. Specifically, this Association has for many years urged development of a means to provide a Cockpit Display of Traffic Information (CDTI). This device could relieve the controller of some workload inherent in separating aircraft and could, if accurate, permit reduction in separation standards as well as reducing "control loop" time. This does not imply that pilots desire or would accept full responsibility for aircraft separation. The primary separation responsibility is a function of the ground based system, but a Cockpit Display of Traffic Information would allow pilots to accept limited responsibilities in Instrument Flight Conditions (IFR). The FAA Plan briefly acknowledges this without emphasis. The development and use of CDTI should be given a high priority in the Plan.

Automated En Route Air Traffic Control (AERA)

The basic objectives of AERA -- to reduce operating costs for both the users and the FAA, to accommodate a growth in IFR traffic at minimal cost, and to increase the overall efficiency and safety of the system -- can certainly be endorsed. In fact, AERA represents the first serious attempt by the FAA to put a complete system together using the advanced computer technologies available to both the ground and airborne systems. However, the AERA concept, as it now exists, appears to be totally "ground oriented" in that it proposes to develop on the ground optimum routings and flight profiles, generate clearances, develop severe weather avoidance profiles, and issue instructions necessary to prevent traffic conflict, all without providing the pilot options to evaluate based on all operational factors known to him. This Plan orientation is not appropriate. The pilot must be in the evaluation and decision "loop."

Additionally, in an environment totally dependent on data link for communications between the pilot and ATC system, such as AERA, it is absolutely essential that the aircrew have the capability to validate control instructions and to retain a limited picture of the traffic situation within a reasonable distance of his flight path. This capability could be provided through the Cockpit Display of Traffic Information. With implementation of AERA and dependence on automation in the ATC system, it becomes absolutely vital that an independent backup airborne collision avoidance system be provided and the Cockpit Display of Traffic Information becomes an essential backup element to AERA to obtain pilot acceptability and confidence in the system.

TCAS

One basic assumption of the Plan is that "a very high level of midair collision protection, including a backup ground-independent airborne separation device, called TCAS, will be available." While the Plan describes a positive implementation strategy which mandates Mode S transponders, no such provisions are described for TCAS. As described by FAA, "TCAS II will be a full-scale collision avoidance system capable of operating in high-density airspace and providing not only collision avoidance information, but also a direction-to-look for the pilot to spot conflicting aircraft." [1] A system which meets these basic requirements is essential to the success of the NAS Plan; therefore, current CAS development efforts should concentrate on providing such a system. Accordingly, the requirement to carry an FAA described TCAS II should be mandated for air carriers to insure that the critical assumption made concerning the availability of this system in the NAS Plan is actually realized.

Summary

In summary, the National Airspace System Plan is an excellent plan which reflects extraordinary vision and reasonable goals. We strongly urge further considerations and Plan refinements concerning the following:

1. TCAS implementation;
2. Cockpit Display of Traffic Information;
3. Implementation of higher levels of automation; and
4. Airport capacity problems

This concludes my statement Mr. Chairman. Once again we appreciate this opportunity to present ALPA's views on this important subject and we will be pleased to answer any questions which you and your colleagues might have.

Reference

[1] Statement of Albert P. Albrecht, Associate Administrator for Engineering and Development, Federal Aviation Administration, before the House Committee on Science and Technology, Subcommittee on Transportation, Aviation and Materials concerning the FAA R, E&D Program. February 24, 1982.

Mr. Glickman. Thank you, Mr. Cotton.

Mr. Broadwater. Mr. Chairman and members of the subcommittee, the Air Traffic Control Association is a professional society of air traffic controllers, flight service specialists, aircraft operators, pilots, engineers, and other persons having an interest in the science of air traffic control. We appreciate the opportunity to appear before you today.

We believe the national airspace system-plan, as developed by FAA, sets a bold course and much needed improvement in the U.S. air traffic control system. The FAA is to be congratulated for putting together a comprehensive plan encompassing resolutions to a number of longstanding system-development issues.

ATCA fully recognizes the national airspace system plan as just a plan, and we intend to comment accordingly. We fully understand that, lacking specifics, it is too early to attempt an indepth analysis of all the issues. Our comments are offered on the present plan with the understanding that we will make additional assessments as FAA more clearly defines details of the plan.

We strongly support the system improvements cited in the plan, as well as the concepts, acquisition and implementation aspects of the plan. We will not address the funding mechanisms for financing the plan, as comments of this sort more properly come from those users more directly affected by the proposed increases in user taxes. In general, however, we feel the plan and the new systems are a wise investment as they replace aging and costly to maintain elements of the current system with modern equipment that will expand system capacity and permit wider use of fuel efficient procedures while maintaining today's high safety levels, as well as reduce FAA's cost of providing ATC services.

In our analysis, we have considered the following elements of the plan: automation; surveillance; collision avoidance; communications; navigation; ATC systems, operations, procedures, and airspace. Many phases of the plan are consistent with the user consensus, as stated in the 1979 E. & D. initiatives report. Our details of the particular systems are discussed in depth in our presentation, Mr. Chairman, so we will skip that portion.

We do feel that the schedule is somewhat ambitious, calling for a number of significant system implementations and operational changes to occur simultaneously or in quick succession. We feel that a well-thoughtout transition strategy needs to be developed giving adequate time for ATC and support personnel to accommodate equipment, airspace, and operational changes.

We support the system of the replacement of the host computer as presented in the plan, and the interim transition to the new system in the 1990's. We support many of the specifics, as has been put in our paper.

I would like to say in summary that the decisiveness and scope of FAA's plans for system modernization are commendable. The plan appears to maintain the proper balance of meeting current needs for interim improvements without foreclosing the preferred options for obtaining the large increments in system performance that are ultimately required. It is now necessary for the FAA to acquire the funds for and develop the organizational structure that will start and complete these tasks.

Many of the systems proposed in the plan are realizable only as a result of earlier engineering and development efforts that proved the value of particular technology for ATC. Such efforts should continue and be assured adequate funding, even in the face of larger resource requirements for major system acquisitions.

We appreciate the opportunity to present our views.

[The prepared statement of Mr. Broadwater follows:]

STATEMENT OF
THE AIR TRAFFIC CONTROL ASSOCIATION, INC.
BEFORE THE SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
U. S. HOUSE OF REPRESENTATIVES
April 28, 1982

Mr. Chairman and Members of the Subcommittee:

We are a professional society of air traffic controllers, flight service specialists, aircraft operators, pilots, engineers, and other persons having an interest in the science of air traffic control. We appreciate the opportunity to appear before you today.

The National Airspace System Plan developed by the Federal Aviation Administration sets the course for bold and much needed improvements in the U. S. Air Traffic Control System.

The FAA is to be congratulated for pulling together a comprehensive plan encompassing resolutions to a number of long standing system development issues.

ATCA fully recognizes the National Airspace System Plan as just a plan, and we intend to comment accordingly. We fully understand that, lacking specifics, it is too early to attempt an in-depth analysis of all the issues. Our comments are offered on the present plan with the understanding that we will make additional assessments as FAA more clearly defines details of the plan.

We strongly support the system improvements cited in the plan, as well as the concepts, acquisition, and implementation aspects of the plan. We will not address the funding mechanisms for financing the plan, as comments of this sort more properly come from those users more directly affected by the proposed increases in user taxes. In general, however, we feel the new systems are a wise investment as they replace aging and costly to maintain elements of the current system with modern equipment that will expand system capacity and permit wider use of fuel efficient procedures while maintaining today's high safety levels, as well as reduce the FAA's cost of providing ATC services.

We have considered the following elements of the Plan:

Automation
Surveillance
Collision Avoidance
Communications
Navigation
ATC Operations / Procedures / Airspace

Automation

The plan calls for the capacity and reliability of en route automation to be improved in the mid 80s through the implementation of a new Host computer that is to be instruction compatible with the present NAS Stage A. A concurrent development effort will provide a new system design for the late 80s incorporating the Host with new software and a redesigned controller sector suite. The new system design and software would accommodate controller productivity and user routing and operations flexibility, and is identified as the Automated En Route ATC (AERA) concept of air traffic control.

This will provide for the needed interim upgrading of en route automation reliability and capacity, without impeding the attainment of longer-range improvements in productivity and development of more fuel efficient routings and operations. This phase of the plan is responsive to the user consensus as stated in the 1979 E&D Initiative Report.

Terminal automation would be subsequently upgraded using elements of this same hardware and software. There would also be a consolidation of terminal services into approximately 30 large TRACONs that in addition to providing approach and departure control may have responsibility for ATC services in the contiguous en route airspace at the lower altitudes. At a number of remote airports, approach control services would be provided by the en route center.

Common elements of the advanced automation system would also be used to upgrade the offshore control facilities and the central flow control facility. The initial upgrading of central flow facilities is to be accomplished quickly through direct purchase of a readily available computer system.

The schedule is ambitious, calling for a number of significant system implementations and operational changes to occur simultaneously or in quick succession. A well thought out transition strategy needs to be developed, giving adequate time for ATC and support personnel to accommodate equipment, airspace, and operational changes.

The focus of the plan is on en route automation improvements with terminal upgrades to be accommodated as a subcategory. Time frames for terminal system implementation and the TRACON consolidation are not clearly stated but appear to occur after the en route system implementation. Common terminal and en route automation systems have desirable development and operational advantages, but large increments in terminal automation may not be deferable until the early 1990s, even with the planned interim upgrades to the ARTS III and ARTS II systems. The presently depressed economy and controller job action related flow constraints on terminal operations have minimized the current levels of terminal delay and congestion, but the major terminals are and will continue to be the limiting factor in total system capacity. Full FAA commitment to interim terminal upgrades as well as the longer range upgrades will be necessary to maintain balanced traffic handling capabilities across the system.

Surveillance

The plan specified a transition to Mode S beacon (the ICAO designator for DABS), with mandatory equipage of the Mode S transponder, and in the same airspace data link, to receive ATC services in higher altitude airspace by the 1990s. Primary radar upgrading is called for in terminal areas with a de-emphasis and finally a phase out of primary radar for en route control in the late 1990s. Weather radar, in the form of the NEXRAD system, possibly complemented by a terminal weather radar, will provide the ATC system and aviation users with more complete and timely information on precipitation, movement of weather fronts and precipitation related turbulence.

Again, the plan captures many of the aviation users consensus views as expressed in the E&D Initiatives report. The Mode S adoption maintains conformance with international standards while providing the automatic, ground-to-air data link that is the foundation for advanced automation, and pilot access to and exchange of a host of desirable weather and flight planning data while in flight. Mandatory equipage of Mode S can be accomplished in a phased manner with adequate prior notification, and should not impose an unnecessary cost burden on users now equipped with ATCRBS avionics. We believe that emphasis on improved weather detection versus aircraft detection via search radar, particularly in the en route environment, establishes the correct priorities.

Collision Avoidance

The plan restates FAA's establishment of the family of Threat Alert and Collision Avoidance Systems (TCAS) to fulfill the airborne collision avoidance role, complemented by the ground-based Aircraft Traffic Advisory Service (ATAS) that is to be provided through the Mode S data link. The stated clarification of the FAA position on collision avoidance has concluded many years of debate and resulted in a viable system. The FAA may want to consider permitting users that desire system implementation before TCAS is available to adopt the technically similar Beacon Collision Avoidance System (BCAS) that has reached maturity after considerable evaluation, including the successful completion of in-service flight tests.

Communications

The FAA has made a commitment to complete the upgrading of digital communications through the National Airspace Data Interchange (NADIN) system and to establish modernized voice switching and distribution systems at en route, TRACON, and FSS facilities through a yet to be defined Voice Switching and Control System (VSCS). Further economies are to be sought with the integration of Remote Maintenance Monitoring (RMM) in these systems.

The attainment of a modernized, flexible communications system including more economical use of leased communications lines, has been an elusive FAA objective. The new FSS, en route, and later TRACON facilities called for in the plan will require the new compatible communication systems to support an efficient transition to new facilities. Early FAA attention must be given to establishing firm operational and technical requirements for such systems and then proceeding to acquire or lease the systems on a schedule that is in phase with the implementation of major new facilities.

Navigation

The plan calls for full implementation of MLS over a long period and the immediate end to ILS acquisitions. Full ILS phase out would be accomplished consistent with ICAO protection dates. Continued dependence on VOR/DME, complemented by LORAN-C and OMEGA where operationally desirable, is also implied in the plan.

The commitment to MLS implementation including the Precision DME, establishes a course for improved precision landing system performance and more widespread deployment than is possible with ILS. The far term navigation proposals are consistent with the early versions of the Federal Radionavigation Plan and are almost certain to be confirmed by later studies. User investment in VOR/DME, the recent FAA modernization of the ground based VOR elements, and many years of satisfactory VOR/DME use supports the correctness of this choice.

ATC Operations / Airspace

The FAA plan calls for a reduction of the number of en route centers through airspace and center consolidation, formation of approximately 30 large TRACONS that would provide control for multiple large terminals and may provide control for en route operations in the contiguous low altitude airspace. Approach control services for some isolated terminals would be provided from the en route center.

The FAA plan is consistent with user interest in reducing overhead operating costs and eliminating artificial control boundaries. The consolidation of facilities may, however, create cumbersome new boundaries, particularly if the large new TRACONS control extensive low altitude airspace. Perhaps of more concern is the potential for the remotely located approach control function to not have complete and accurate information on airport capacity and the dynamics of runway, taxiway, and terminal airspace utilization. Such data and forecasts are of prime importance in maintaining efficient flows of traffic through the limiting link in ATC, the airport. Indeed, the TRACON consolidation may heighten the need for a terminal planning aid that the FAA has explored to maintain high levels of balanced en route and terminal traffic.

The availability of advanced automation that would permit more users to fly preferred direct routes and the airspace changes resulting from facility consolidation emphasize the need for the National Airspace Review program proposed by the FAA. It is expected that such a review could yield tangible near term advantages by removing some artificial limitations on current operations. The FAA is urged to start work on this program soon, soliciting full participation in the process from a broad range of aviation users and industry.

The plan should also consider airspace issues as they relate to VFR aircraft in major terminal complexes. It is reasonable to assume that as major terminals become more complex, specific procedures and dedicated airspace will be required to accommodate increased VFR operations. This issue is of paramount concern at present and should be included in any comprehensive plan involving future airspace use.

Conclusion

In summary, the decisiveness and scope of the FAA's plans for system modernization are commendable. The plans appear to maintain the proper balance of meeting current needs for interim improvements without foreclosing the preferred options for obtaining the large increments in system performance that are ultimately required. It is now necessary for the FAA to acquire the funds for and develop the organizational structure that will start and complete these tasks.

Many of the systems proposed in the plan are realizable only because of earlier engineering and development efforts that proved the value of particular technology for ATC. Such efforts should continue and be assured adequate funding, even in the face of the large resource requirements for major system acquisitions.

We greatly appreciate the opportunity to present our views to the Subcommittee. Thank you.

Mr. **Glickman**. Thank you, Mr. Broadwater.

Mr. Johannssen, it is a pleasure to have you here.

Mr. **Johannssen**. Thank you, Mr. Chairman.

Let me assure you that we share the vast concerns of this subcommittee, the Congress and the American people over the FAA's ability to provide that safety to the flying public is maintained at the highest possible level for now and in the future.

We have testified before numerous subcommittees in the past 3 years on various problems that have plagued the FAA. While the majority of these still exist, the environment of the FAA has changed radically in this last year. With this thought in mind, we have concentrated on questions in problem areas we feel are of utmost and immediate importance to maintain the integrity of the future of our profession and the national airspace system.

The overwhelming concern that we have for the FAA is their ability to meet the needs of the entire aviation community with minimal inconvenience and increased safety to the flying public in the next few years, particularly during the proposed rebuilding process. It is our professional opinion that, unless this subcommittee and Congress act positively in the near future, the FAA will be unable to achieve that mission.

The major problem is that our profession too long has been overlooked and ill treated in the overall plans of the FAA. For example, Administrator Helms recently released the national airspace system plan that will chart a comprehensive plan for the modernization and improvement of the air traffic control and airways facilities services from now to the year 2000. The plan itself sets projections within time parameters so that, by the year 2000, the FAA will have revitalized the entire national airspace system.

We are sorry to report that the Administrator unilaterally moved in this direction without comment or feedback from the people within the FAA who will have the ultimate responsibility for the successful completion of this plan. Only under the threat of filing an unfair labor practice complaint and seeking a temporary restraining order from the Federal Labor Relations Authority did the Administrator share this plan with us. This attitude must change if we are to be successful in rebuilding the system.

There has been much discussion and concern over the rebuilding of the national air traffic control system. I assure you that PASS has the willingness and the character to see the job through. We are the backbone of the system, and we are proud of it. As Administrator's come and go, we will continue to be the one remaining efficient standard this system has. I plan to be here throughout the rebuilding process. It is unfortunate the Administrator cannot make the same commitment.

It is generally agreed that a complete revision and modernization of the U.S. air traffic control system is required, if not overdue. The present data processing equipment is antiquated, subject to unacceptable failure rates and, in many locations, memory storage is near capacity.

It is less clear that the current proposal, at least as described in the FAA Administrator's December 1981 program plan, is appropriate or adequate. The description of the various components is general, vague, and indefinite in many cases. Much of the technology on which it relies has not yet been fully developed or tested. The plan is notably lacking in cost estimates, either for the system or the users thereof. The ideas calling for fully redundant computer systems, data processing equipment, modernized navigational, and communications gear are all excellent and a consensus can certainly be found for support.

Nevertheless, there are still many troubling questions yet to be resolved. I will list but a few of them for you:

One, how much of the required technology is presently developed and/or presently available for off-the-shelf purchase?

Two, what is the specific timeframe for developing each necessary item. Who will do the developing? How much will be held inhouse for FAA R. & D.? How much will be put out for bid by independent contractors? What cost controls will there be on these independent and development contracts?

Three, I feel this is a very important item. Will there be an outside or nongovernmental panel of experts appointed to oversee the R. & D. process? In the past, the Federal establishment has frequently made use of "blue ribbon" panels of experts in various fields and something similar could be effectively implemented here.

Four, heavy emphasis is placed on a new system of maintenance, called remote maintenance monitoring. This is expected to reduce AF staffing requirements significantly and result in vast and dramatic cost savings. Are the claims made by this technique valid? Have they been previously tested on a nationwide, technology-intensive system where a high standard of accuracy and reliability is required? We view remote maintenance monitoring as an expensive, overcharacterized, and counterproductive system that will expand outage time and expense.

Five, is it proven that solid-state equipment, such as FAA plans to install, is really less maintenance intensive than the present and older tube-type equipment?

Six, can it be shown that the new generation data processing and communication systems are genuinely more energy efficient than present equipment?

Seven, new technology will require intensive retraining for airways facilities personnel. Are plans for that being developed concurrently with plans for introduction of the equipment? Failure to do so could result in a serious lack of skilled personnel to adjust, maintain, and certify the system during the very critical transition period.

Eight, the plan calls for increasing AF productivity by a factor of two by the year 2000 with a consequent reduction of one-third in AF staffing. Is there any basis for this projection? What is the supporting documentation?

Nine, to what extent is the planned use of outside maintenance personnel factored into the cost and personnel savings projected in the plan?

Ten, the FAA estimates that the average cost of an airways facilities technician in 1981 dollars is $34,100 per annum. That is totally inaccurate. Our pay today in that range is $27,000.

Eleven, the plan estimates total cost savings of $24 billion by the year 2000. Again, where are the detailed breakdowns and supporting data for these significant economies?

Twelve, we feel the above questions must be asked, but also must be answered before this subcommittee can make a reasonable determination on the initial voluminous expenditures on a future system. We understand the system had a $9 billion price tag in December of 1981. Before an April meeting of the OTA, the Administrator indicated the cost at $14 billion. Where did we get that additional $5 billion from?

There are critical elements that this subcommittee must be aware of that have not been addressed by the FAA's testimony. On March 17, 1982, Secretary Lewis and Administrator Helms released a task force study of management-employee relationships in the FAA. We commend the Secretary and the Administrator on initiating the important study. It does present a clear indication of the tragic management-employee relationship as it exists within the FAA today. The outcome of the study, on the other hand, is of no great surprise to us.

In testimony before this subcommittee, Associate Administrator Albrecht stated,

> Human limitations constitute a major cause of accidents and errors today. Future systems must be human-error tolerant and provide the proper allocation of functions between man and machine. Our human factors program is aimed at system performance enhancement and error reduction, both in the cockpit and on the ground.

He goes on to say,

> The experiments to be conducted will utilize human factor laboratories located at NASA Ames, NASA Langley, Wright Patterson Flight Dynamic Laboratory, and the FAA Technical Center, and will consider cockpit and controller environments.

Once again, cockpit and controller environments survive. What happened to systems specialist requirements within the future system?

For years we have testified to and discussed many of these problems with anyone who would listen. We feel these internal problems within the FAA are, in part, the reasons for many past failures of the FAA programs and policies. We do identify with the attitudes and feelings disclosed by this report and wish to reverse them. Now that the FAA has focused on the problem, it will be our mutual responsibility as employee representative and management to rebuild and recommit our energies not only to the greatest technical system in the world, but also to the greatest humanistic labor-management system in the world.

FAA plans will invariably change 1,000 times before completion of this program is realized. Everyone must understand that we cannot allow solely economic issues to deter our joint resolve in a continuing effort to make the national airspace system the safest, most efficient system in the world.

Thank you for allowing us to present our views on the national airspace system plan. I would be happy to answer any questions you might have.

[The prepared statement of Mr. Johannssen follows:]

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President
Howard E. Johannssen
Executive Vice President
Mark E. Schneider

STATEMENT OF HOWARD E. JOHANNSSEN
PRESIDENT, PROFESSIONAL AIRWAYS SYSTEMS SPECIALISTS
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
APRIL 28, 1982

Mr. Chairman and Members of the Committee:

The Professional Airways Systems Specialists (PASS) commends you on your wisdom and approach in the scheduling these hearings on all aspects of the National Airspace System plan. The current situation within the Department of Transportation/Federal Aviation Administration (DOT/FAA) and its ability to meet the chartered mission of safety in the future is indeed in serious question. We share the vast concerns of this Subcommittee, the Congress and the American people over the FAA's ability to provide that safety to the flying public is maintained at the highest possible level for now and in the future.

In recent months, the news media has been full of reports on aircraft tragedies. We, as professionals, are concerned by the continuing reports of aircraft accidents and near calamities. The National Transportation Safety Board is continuing its investigation into the tragic crash of the Air Florida jet into the Potomac, as well as the World Airways accident at Boston's Logan Field. Several months ago an Air California Boeing 737 narrowly escaped tragedy when its landing gear collided with high tension wires at a dangerously low altitude.

We also read of the mid-air collision involving an Air National Guard KC 135 and a small aircraft. Once again, all were

"We Will Either Find A Way or Make One"

killed. Fortunately, the wreckage fell into an area that did not cause the further loss of life to anyone on the ground. Had this been over one of our nation's cities, we would have experienced a greater holocaust.

We are confident that once all these accidents have been investigated, the true facts surrounding these incidents will become public knowledge. It is our opinion that our National Airspace System has been pushed to the greatest extreme and that we must use every bit of available funding, expertise and experience to prevent future tragedies.

We have testified before numerous subcommittees in the past three years on various problems that have plagued the FAA. While the majority of these still exist, the environment of the FAA has changed radically in this last year. With this thought in mind, we have concentrated on questions and problem areas we feel are of utmost and immediate importance to maintaining the integrity of the future of our profession and the National Airspace System.

The overwhelming concern that we have for the FAA is their ability to meet the needs of the entire aviation community with minimal inconvenience and increased safety to the flying public in the next few years, particularly during the proposed rebuilding process. It is our professional opinion that unless this Subcommittee and Congress act positively in the near ~~future~~ FUTURE, the FAA will be unable to achieve their mission.

A major problem is that our profession for too long has been overlooked and ill-treated in the overall plans of the FAA. For example, Administrator Helms recently released the National Airspace System plan that will chart a comprehensive plan for the modernization and improvement of Air Traffic Control and Airways Facilities services from now to the year 2000. The plan itself sets projections within time parameters so that by the year 2000 the FAA will have revitalized the entire National Airspace System.

We are sorry to report that Administrator Helms unilaterally moved in this direction without comment or feedback from the people within the FAA who will have the ultimate responsibility for the successful completion of this plan. Only under the threat of filing an unfair labor practice complaint and seeking a temporary restraining order from the Federal Labor Relations Authority did the Administrator share this plan with us. This attitude must change if we are to be successful in rebuilding the system.

There has been much discussion and concern over the rebuilding of the national Air Traffic Control system. I assure you that PASS has the willingness and character to see the job through. We are the backbone of the system, and proud of it. As administrators come and go, we will continue to be the one remaining efficient standard within this system. I plan to be here throughout the rebuilding process. It is unfortunate the Administrator cannot make this same commitment.

It is generally agreed that a complete revision and modernization of the United States Air Traffic Control system is required, if not overdue. The present data processing equipment is antiquated, subject to unacceptable failure rates, and in many locations, is nearing memory storage capacity.

It is less clear that the current proposal, at least as described in the FAA Administrator's December 1981 program plan, is appropriate or adequate. The description of the various components is general, vague and indefinite in many cases. Much of the technology on which it relies has not yet been fully developed or tested. The plan is notably lacking in cost estimates either for the system or for users thereof. The ideas calling for fully redundant computer systems, data processing equipment, modernized navigational and communications gear are all excellent and a consensus can certainly be found for support.

Nevertheless, there are still many troubling questions yet to be resolved. I will list but a few of them for you. We raise these concerns today in an attempt to establish a free flow of information so that this Subcommittee and others may have the opportunity to base their decisions on the new system, utilizing factual data and realistic supportive documentation.

1. How much of the required technology is presently developed and/or presently available for off-the-shelf purchase?

2. What is the specific time frame for developing each necessary item? Who will do the developing? How much will be held in house for FAA R&D? How much will be put out for bid by independent contractors? What cost controls will there be on these independent design and development contracts?

3. Will there be an outside (i.e., non-government) panel of experts appointed to oversee the R&D process? In the past the federal establishment has frequently made use of "blue ribbon" panels of experts in various fields and something similar could be effectively implemented here.

4. The program plan calls for new host computers to take over from the present IBM 9020s by using the present software. At a later stage new software will be developed to be used by the replacement computers. Is this sort of "piggyback" or "leap-frog" process technically viable? Has it ever been used before? If so, has it ever been tried on so massive a scale as is called for here? Our concerns stem from failures in the NORAD and U.S.A.F. Phase Four Programs.

5. The plan calls for something akin to positive control down to 6,000 MSL within a decade. Any aircraft participating in the system will have to carry a Mode S transponder. What is the estimated cost of such equipment? Will anyone failing to purchase it be effectively excluded from the system?

6. If that indeed is the case, will there be a compression of VFR general aviation traffic below 6,000 MSL, with a resulting derogation of safety and increased chance of mid-air collision?

7. The plan cites projected traffic figures for the air traffic system through the year 2000. On what calculations are they founded? A more substantial data base, alone with exposition of underlying assumptions, is essential.

8. Heavy emphasis is placed on a new system of maintenance, called remote maintenance monitoring (RMM). This is expected to reduce AF staffing requirements significantly and result in vast and dramatic cost savings. Are the claims made for this technique valid? Have they been previously tested on a nationwide, technology intensive system where a very high standard of accuracy and reliability is required? We view RMM as an expensive, over-

characterized and counter-productive system that will expand outage time and expense.

9. Is it proven that solid state equipment, such as FAA plans to install, is really less maintenance intensive than present and older tube type equipment.

10. Can it be shown that the new generation data processing and communication systems are genuinely more energy efficient than present equipment?

11. New technology will require intensive retraining for AF personnel. Are plans for that being developed concurrently with plans for introduction of the equipment? Failure to do so could result in a serious lack of skilled personnel to adjust, maintain and certify the system during the very critical transition period.

12. Will training for AF personnel continue to be handled through the FAA facility in Oklahoma City or will more of it be turned over to independent contractors, be they the equipment manufacturers or other specialists?

13. The FAA has an unfortunate history of commissioning new systems, i.e., placing them on line in a live traffic environment, before they are completely tested and debugged in a laboratory environment. With the magnitude of the transition proposed in the new plan, an intensive shakedown is essential. Yet the plan is silent on plans for same.

14. The plan calls for increasing AF productivity by a factor of two by the year 2000 with a consequent reduction of one-third in AF staffing. Is there any basis for this projection? What is the supporting documentation?

15. The report is vague on how much of the next generation equipment will be leased, including terms and conditions that would be considered. Details are necessary.

16. If use of new technology satellite communications systems are planned, will this equipment and the ground support facilities necessary for its use be maintained by FAA staff or by outside contractors? Will it be time shared with other agencies?

17. To what extent is the planned use of outside maintenance personnel factored into the cost and personnel savings projected in the plan?

18. The FAA estimates that the average cost of an AF technician in 1981 dollars is $34,100 per annum. This is not accurate. What is the basis for the calculation?

19. The plan estimates total cost savings of $24 billion by the year 2000. Again, where are the detailed breakdowns and supporting data for these significant economies?

We feel the above questions must be asked, but must also be answered before this Subcommittee can make a reasonable determination on the initial voluminous expenditures on a future system. We understood the system to have a $9 billion price tag in December of 1981. Before an April meeting of the Office of Technical Assessment, the Administrator indicated the cost at $14 billion. Just what is the estimated cost of this system?

There are critical elements that this Subcommittee must be aware of that have not been addressed by the FAA's testimony. On March 17, 1982, Secretary Lewis and Administrator Helms released a task force study of management-employee relationships in the

FAA. We commend the Secretary and the Administrator on initiating this important study. It does present a clear identification of the tragic management-employee relationship as it exists within the FAA today. The outcome of the study, on the other hand, is of no great surprise to us.

In testimony before this Subcommittee, Associate Administrator Albert P. Albrecht stated, "Human limitations constitute a major cause of accidents and errors today. Future systems must be human-error tolerant and provide the proper allocation of functions between man and machine. Our human factors program is aimed at system performance enhancement and error reduction, both in the cockpit and on the ground." He goes on to say, "The experiments to be conducted will utilize human factor laboratories located at NASA Ames, NASA Langley, Wright Patterson Flight Dynamic Laboratory, and the FAA Technical Center and will consider cockpit and controller environments." Once again, cockpit and controller environments survive. What happened to systems specialist requirements within the future system?

For years we have testified to and discussed many of these problems with anyone who would listen. We feel these internal problems within the FAA are, in part, the reasons for many past failures of the FAA programs and policies. We do identify with the attitudes and feelings disclosed by this report and wish to reverse them. Now that the FAA has focused on the problem, it will be our mutual responsibility as employee representative and management to rebuild and recommit our energies not only to the greatest technical system in the world, but also to the greatest humanistic labor-management system in the world.

FAA plans will invariably change a thousand times before completion of this program is realized. Everyone must understand that we cannot allow solely economic issues to deter our joint resolve in a continuing effort to make the National Airspace System the safest, most efficient system in the world.

Thank you for allowing us to present our views on the National Airspace System Plan. I would be happy to answer any questions you might have.

Mr. Glickman. Thank you for your testimony.

Mr. Johannssen, the committee is most appreciative of the fine work that your members do in maintaining the equipment.

Mr. Johannssen. Thank you, Mr. Chairman.

Mr. Glickman. I guess my first question would relate to technology. You, in your statement, Mr. Johannssen, and you implied in your statement, Mr. Broadwater, you talked about a broad variety of technological changes that are going on right now. We are talking about a long-term plan here. We would have the choice of introducing present-day technology into a system that is going to cost a lot of money to finish and, in 20 years, the technology would be old; or we have the choice of beginning the development of technology, realizing that it is going to evolve over the next 5, 6, 7, or 8 years as it has gone on line.

What I am concerned about is that if, in fact, we get all the kinks right now out of technology, we are going to end up with not future technology, but existing technology, logically increasing the likelihood for early obsolescence of equipment.

I guess what I am saying is though a lot of questions you raise are legitimate questions, I am fearful that one could argue that we will never resolve all of the technological problems and, therefore, we should never move ahead with anything new because it will always be evolving and changing, so let us just go with what we have now.

Mr. Johannssen. I believe you are correct. The technology is going to continue to change, so when we are there in 1990 or 2000, we are going to look around and still have an older system.

The problem as I see it is rushing ahead into unproven technology where we have an old technology that works. I believe that is the issue that we must address—that is being concerned before going forward, we now have something that works, that has been tested, and we can believe is a reliable system. If we don't do that, we are going to end up with a serious problem, and that relates to broken bodies in our industry.

Mr. Glickman. The Administrator, I think—I can't speak for him—but he would argue that what he is talking about is replacing new hardware. The software that would be used would be an evolving part of the situation. We may be involved with using existing software for a while, and that is what would be adaptable to change as the world changes, so to speak. Therefore, it would give us that kind of protection so that we wouldn't absolutely bind ourselves on a technology that will in fact be a wrong one.

Do you have any problem with that general philosophy?

Mr. Johannssen. Well, as the system plan goes forward, there are so many portions of that plan dependent on others and others independent of each other, that—I will speak about the en route process now, the centers and the updating of the computers, the 9020A going to a 9020D versus other methods. We have no problem with any one of the choices, recognizing that some are more expensive, and some will get us there sooner than others.

One of the questions I have of the FAA is, do we want to once again increase capacity and work toward the enlarged system? Do we want to maintain the capacity we have now? We haven't set ourselves a priority of what we want to do. We have some really good ideas, and most often they don't conflict. But is capacity the No. 1 objective versus productivity, or is it not? We haven't set a specific direction in which we want to go. I think that plan lacks that goal.

Once we do that, then the objectives can be determined and we can take those steps safely. But FAA has not done that. We don't have a reachable specific objective to this plan except to be someplace else 20 years from now—one argument is that we develop productivity; the other is capacity. What is the bottom-line factor? We don't know what it is, and we can't make any decisions until we know the answer to this question.

Mr. GLICKMAN. Mr. Broadwater?

Mr. BROADWATER. I would submit that, looking back at the history of the implementation of the 9020 system, the time it took us to get that in, by the time it was in, it was totally obsolete, and we have been, as you said, outdistanced in technology. I believe that we have to give ourselves a chance to put in that kind of equipment and also keep an open end so that we can add to it as new technology develops. We got to start someplace, I guess, is where it comes to coming up with a new system.

Mr. GLICKMAN. Mr. Cotton.

Mr. COTTON. Yes; we agree also with the FAA's philosophy of transition in this case. The hardware that we buy and install should be the most capable that you can get, and then we will allow the software to evolve as we are able to absorb it.

Mr. GLICKMAN. You raised some very good points here. I have talked to the Administrator many times about it. He tells me that essentially the kind of technology that he is talking about in the hardware is off-the-shelf technology. It is not new technology, it is the newest that is available now. But he is worried about technology risk involved. I guess that is why he is saying that the software is what will be the evolving part, that the existing computers, even if updated, could not handle new software. I assume that is the thrust of his situation. I guess what he is trying to do is minimize risk as much as he possibly can. But I am not an expert in this situation.

I would ask this: The National Airspace Review Advisory Committee that Mr. Helms has initiated, does it provide an independent oversight over this plan, and is what Mr. Johannssen is saying, that it does not include people such as the people that you represent——

Mr. BROADWATER. Well, I would say the NAR is an integral part of the operational, airspace, and regulatory aspects of the plan as they would integrate into the technological portion. It serves an entirely separate purpose. It is a part of the plan, so to speak.

Mr. GLICKMAN. But I think you implied that you didn't feel that you had appropriate input into the——

Mr. JOHANNSSEN. That is correct. At this point, Mr. Helms and I have never spoken. I have requested meetings with him many times. Neither has Mr. Lewis. There just seems to be a desire by the FAA to keep us totally on the outside of this whole process.

Quite frankly—and don't misunderstand what I say—this plan, as it goes into effect, the impact and implementation it has on the people of the system is negotiable. I will be doing that negotiating.

I believe we want to work together now. Unfortunately, the PATCO strike or whatever happened. I represent the employees of the FAA, but we don't represent the same position that PATCO took, but we are being treated in that same manner. This plan won't go forward smoothly if that continues, quite frankly.

Mr. **Glickman**. You referred to the management report that came out last month.

Mr. **Johannssen**. That is correct.

Mr. **Glickman**. Curiously, have you seen any changes, encouraging views, modifications in FAA policies since that report came out?

Mr. **Johannssen**. Quite frankly, it has gotten abruptly worse.

Mr. **Glickman**. The chairman of that committee is from my hometown. It was a surprise that Larry Jones, president of the Coleman Co.—I am told that it is a very well-prepared report.

Mr. **Johannssen**. I met with Mr. Jones after he briefed the Administrator, and I received the same briefing. I concur with the report, and really want to turn things around wholeheartedly.

Mr. **Glickman**. Well, you say it is becoming worse. What do you mean? Give me some examples.

Mr. **Johannssen**. Well, historically the Administrator, Mr. Bond and his predecessors, have always talked to the people who represent the people within the FAA, whether they are agreed or not. They always had the ground to discuss their mutual problems and, hopefully, resolve them.

Mr. Helms just flat refuses to meet with us, period. We can talk with his Director of Labor Relations and, in fact, we are entering into negotiations May 12 with the FAA for a new proposed contract. I didn't want this to be a forum to address that contract. We will do that at the table.

Mr. **Glickman**. No; I don't want to talk about the contract; what I want to talk about is spending billions and billions and billions of dollars on a system, and I also don't want to to see your views here colored by other difficult problems, either. I want to insure that you have objective input into capital systems. After all, you are the people who are responsible for maintaining these systems, so I assume your advice ought to be fairly relevant into what sort of systems they come up with.

Mr. **Johannssen**. Last year, Congressman Whittaker, after viewing the FAA in his reports and such, I met with his staff several times and there was an interest to introduce legislation which would set up a panel of both FAA and employee organizations to overview the processes, to report back to the Congress, so that it would be an open forum where we could bring back legitimate information.

Mr. **Glickman**. I guess what concerns me is the Jones report indicated that some of the employee grievances were in fact bona fide. I just want to insure that these problems are rectified, or else the $9 billion we are going to spend on this system modification, those expenditures may not be as worthwhile to the taxpayers.

Mr. **Johannssen**. I wholeheartedly agree with you.

Mr. **Glickman**. Captain Cotton.

Mr. **Cotton**. Yes; I would agree also. I think the national airspace review process is going to be extremely important to the success of the whole program. All of the users and operators of the system should be included in this process.

Mr. **Glickman**. Did you gentlemen have an additional comment?

Mr. **Johannssen**. The OTA which recently met—last year I had an opportunity to address the folks there. I submit that, with the list of fine credentials that were representative at this last meeting, why were we excluded. If you go back through our past history you will find that we have been excluded from everything except one meeting which was very productive that the FAA sponsored at their NAFEC Center up in Atlantic City, and that was on the humanistic nature, and dealt with how can we better identify and adapt a new system for the human-machine needs.

I understand that the report from that seminar is coming out within the next month or two. I think there are some very valuable contributions by all the members of the aviation community that came from that seminar, where we sat down for a week and discussed these problems. I think that is just one area that we could use as a demonstration of how successful we can work together when allowed to.

Mr. **Glickman**. Let me move to another more technical area. I think that the Air Line Pilots Association, Captain O'Donnell, has testified before, and I think you kind of implied this today, that you support the full implementation of the TCAS II system?

Mr. **Cotton**. That is correct.

Mr. **Glickman**. I wonder if you might relate that to how you think the Administrator ought to move ahead on the TCAS I system, which I think has got to be as relevant to you as your own system in your own airplanes?

Mr. **Cotton**. Well, not exactly, because in order for a TCAS II system to work, it will protect us against any airplane which is equipped with a transponder, period.

Mr. **Glickman**. That is right.

Mr. **Cotton**. So, whether or not another airplane has a TCAS I on board doesn't matter all that much. It will improve the ability of the system to make a safe outcome as it comes along, but it isn't a necessary requirement.

But if the system that we get in the airliner is not the full TCAS II, then we have a very serious limitation. For example, a system which is not a full TCAS II would not even show us where an airplane that had a transponder but did not have an encoder was. It wouldn't even acknowledge its existence, and the full TCAS II would. It would even have the directional information to tell us where to look out the window to find that guy.

Mr. **Glickman**. Under this plan, the productivity of each controller to double and the staff requirements to be reduced by one-third, do you agree?

Mr. **Broadwater**. We find it highly speculative. Having been a traffic controller once in my life, I think that is kind of ambitious on the part of the Administrator to feel that he can reduce the number of persons, based on the way he wants the automation system to work. That is that the controller would be a monitor, so to speak—in other words, I would have to see it. I wouldn't be able to accurately assess from what we presently know in the system.

Mr. **Glickman**. OK. Do you have any comments on that, Mr. Johannssen?

Mr. **Johannssen**. I would just add that as automation increases. We agree it should, that we are the automation people—even though the projections are for reduced staffing, if we look back through the last automation of the FAA, staffing in fact increased quite radically. I can sit here confidently knowing that I have no fear of the people that I represent losing their jobs, but only new positions opening up. I don't feel that their forecasts are accurate, and I feel that workload will increase rather than decrease.

Mr. **Glickman**. OK. Let me ask you another question on the OTA report. The OTA basically has stated that the traffic forecast is much too high and, therefore, the NAS plan should be delayed and perhaps modified with some sort of an interim step.

I am not talking about the collision avoidance part of the plan; I assume I am talking about the computer replacement part of the plan.

I wonder, Mr. Broadwater, if you have any comments on that?

Mr. **Broadwater**. Well, looking at the forecasts over the years, we underestimated in the middle 1960's and we got kind of short, as you probably know. I feel that a forecast is like anything else, it is a projection which you use as a planning document and nothing more, and if it is off 10 percent or 15 percent, it is still within the ballpark enough to do the type of planning we are doing here.

There is no question that the system has to be overhauled, whether or not the forecast is accurate. There is no question that the IFR system is increasing, the number of aircraft that are participating in the IFR function. As it relates to the VFR function, I think that is an important part of this study also. It will come out, I am sure, that there has to be airspace division, regulatory aspects, to decide who is going to play where or what kind of equipment is needed to play where.

But I feel that the forecast itself, it could not be that far off. I think we would be remiss if we stopped planning ahead based on our recurrent projections.

Mr. **Glickman**. OK. I want to thank you all for your excellent testimony today.

We will hold testimony on Thursday in this room at 9:30, hearing from the Defense Department, some of the electronics people, and from some OTA related testimony to try to get some background.

Next week we will mark up the R. & D. portion of this bill.

The hearing will stand adjourned until Thursday.

[Whereupon, at 11:17 a.m., the subcommittee was recessed, to reconvene at 9:30 a.m., Thursday, April 29, 1982.]

FAA NATIONAL AIRSPACE SYSTEM PLAN

THURSDAY, APRIL 29, 1982

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Mr. GLICKMAN. Let us begin the hearing this morning.

Today, the subcommittee will conclude its hearings on the FAA's national airspace system plan and its request for fiscal year 1983 research, engineering and development funds to begin that plan.

So far, we have heard from Administrator Helms on the details of his plan and from representatives of various user groups.

Today, we will continue with testimony from parties outside the FAA who have an interest in its modernization plan. Then, based on this, we hope to move forward with a markup of the R.E. & D. portion of the ADAP bill next Tuesday.

I am pleased to welcome Mr. Dunn. Do you have any comments?

Mr. DUNN. I have no comments, Mr. Chairman.

Mr. GLICKMAN. Let us go ahead and begin. Our first witness today is Mr. Peter F. McCloskey, president of the Electronic Industries Association. It is a pleasure to have you here. You may proceed in any way you wish. Your entire statement will appear in the record. If you want to summarize, it might be useful in terms of giving us more time for questions.

STATEMENT OF PETER F. McCLOSKEY, PRESIDENT, ELECTRONIC INDUSTRIES ASSOCIATION, ACCOMPANIED BY PAUL J. SCALLY, CHAIRMAN, AIR TRAFFIC CONTROL COMMITTEE, ELECTRONIC INDUSTRIES ASSOCIATION

Mr. MCCLOSKEY. Thank you, Mr. Chairman.

Accompanying me today is Paul Scally, the chairman of the Air Traffic Control Committee in the Electronic Industries Association.

The association has a current membership of about 380 companies engaged in research and development, manufacturing and support of electronic components, equipment and systems for government, industrial and a broad range of consumer application.

The EIA Air Traffic Control Committee represents the interests of those of our members who are directly involved in providing hardware and software for use in the air traffic control system that is administered by the FAA. It is on behalf of these companies that we appear before you today.

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We wholly support the need to expeditiously modernize and upgrade the air traffic control system so that it will be capable of safely handling the greater volume of air traffic expected in coming decades. The industry is proud of its role in helping to provide the best air traffic control system in the world today, but we recognize that this system requires full utilization of the current proven technology so as to assure the safe movement of air traffic in the 1990's and beyond.

It is our belief that the improvements proposed in the current national airspace system plan will go a long way toward providing the modernization and upgrading necessary to insure this essential margin of safety. The FAA has produced in this plan the most comprehensive, far-thinking approach to a national air traffic control system that we have seen yet. I think this is perhaps the most important thing. We would like to commend the Administrator for the work that he has done.

I think the industry over the last several years has been concerned about its ability to respond and the clearness of the goals that the FAA has set for itself. The planning here aids in addressing this longstanding concern, so many in the air traffic control field feel that the resources for this industry to compete for FAA type commercial area contracts will be there.

A trend of reallocations of personnel and budget resources toward expanding defense contracting opportunities has been apparent in recent years, raising fears that essential national programs such as the air traffic control modernization effort might fail to receive the best which American technology has to offer. I am happy to report that, as a basis of this plan, we have experienced renewed and expanded interest among our member companies in FAA procurements. We would hope that the plan will be implemented without delay, so that these marshaling resources are not allowed to slip away.

Achieving the economic and technological goals inherent in the proposal will, however, necessarily require its full funding in fiscal year 1983 and the out-years. We wholly support and advocate the making available of airport and airway trust fund money necessary for full implementation of the plan. We recommend that the national airspace system plan funding be specifically called for in the authorization bill, and that Congress enact the necessary fuel and ticket taxes to support it.

Another useful step which the Congress could take would be to opt for a 5-year commitment of funds for FAA while maintaining annual congressional budgetary oversight prerogatives. Such a 5-year commitment would stabilize FAA requirements planning to a much greater extent, and could encourage industry planning and resource commitments to achieve the economies commensurate with long-term funding.

We have been encouraged that the Department of Transportation has recently raised dollar thresholds for procurements requiring approval at the departmental level, thus allowing the Administrator greater authority and flexibility in approving supplier contracts. This was a key concern and a suggested action in our testimony before this subcommittee in February 1980, and we are confident that these higher thresholds will contribute to time and dollar savings in the acquisition process. We believe that movement in the direction of still higher thresholds would further expedite the process of incorporating many of the essential improvements outlined in the modernization plan.

Despite our optimism about the potential of a fully funded NAS plan to address many of the current deficiencies in the national ATC network, we feel compelled to outline a final key concern which could severely impact and impede the success of the proposal. In view of the major systemic changes and expanded funding which has been proposed, will the FAA be able to count on sufficient numbers of skilled technical and procurement personnel to implement its plan? Concerns have been raised that government-wide reductions in authorized personnel strengths may leave FAA seriously undermanned in engineering, management, and key support areas. We urge continued congressional attention and concern in this area to assure that current budgetary savings are not achieved at the expense of a fully modernized air traffic system for the future.

In summary, we believe that the U.S. air traffic control system is maintaining its record as the best in the world. It has been suggested that by expending $10 billion on the current plan, $25 billion in future savings and reductions in personnel levels will be realized.

We in EIA are dedicated to helping FAA realize these savings, while the Nation continues to benefit from the safest air traffic control system which modern technology can provide. To do this, we, the Congress, the industry and the FAA must act collectively, in a prompt and unambiguous manner, to insure the application of our best resources toward this goal.

Thank you, Mr. Chairman.

[The prepared statement of Mr. McCloskey follows:]

STATEMENT BY ELECTRONIC INDUSTRIES ASSOCIATION

Mr. Chairman and members of the Committee, my name is Peter McCloskey, President of The Electronic Industries Association (EIA). Accompanying me is the Chairman of our Air Traffic Control Committee, Paul Scally. Our Association has a current membership of over 380 companies engaged in R&D, manufacture and support of electronic components, equipment and systems for government, industrial and consumer application.

The EIA Air Traffic Control Committee represents the interests of those of our members who are directly involved in providing hardware and software for use in the air traffic control system administered by FAA. It is on behalf of these companies that we appear before you today.

We wholly support the need to expeditiously modernize and upgrade the ATC system so that it will be capable of safely handling the greater volume of air traffic expected in coming decades. The industry is proud of its role in helping to provide the best air traffic control system in the world. We must recognize, however, that this system requires full utilization of the current proven technology so as to assure the safe movement of air traffic in the 1990s and beyond.

It is our belief that the improvements proposed in the current National Airspace System Plan will go a long way toward providing the modernization and upgrading necessary to ensure this essential margin of safety. The FAA has produced in this plan the most comprehensive, far-thinking approach to a national ATC system which we have yet seen. We commend the Administrator and his staff for establishing the type of long-range planning and goal setting on which sound supplier company investment and bid competition strategies can be based.

In this connection, we believe that the openness, comprehensiveness and imagination shown in the NAS Plan will stimulate additional industry participation in FAA competitive procurements, and promote the achievement of all the efficiencies and economies which our competitive free enterprise system is capable of generating. Such planning thus aids in addressing the long-standing concern of many in the ATC field that key industry resources should continue to compete for FAA-type commercial-area contracts. A trend of reallocations of personnel and budget resources toward expanding defense contracting opportunities has been apparent in recent years, raising fears that essential national programs such as the ATC modernization effort might fail to receive the best which American technology has to offer. I am happy to report that we have experienced renewed and expanded interest among our member companies in FAA procurements since the advent of the NAS Plan. We would hope that the plan will be implemented without delay, so that these marshalling resources are not allowed to slip away.

Achieving the economic and technological goals inherent in the proposal will, however, necessarily require its full funding in FY'83 and the out-years. We wholly support and advocate the making available of Airport and Airway Trust Fund monies necessary for full implementation of the plan. We recommend that that NAS Plan funding be specifically called for in the Authorization Bill, and that Congress enact the necessary fuel and ticket taxes to support full funding.

Another useful step which the Congress could take would be to opt for a 5-year commitment of funds for FAA while maintaining annual Congressional budgetary oversight prerogatives. Such a 5-year commitment would stabilize FAA requirements planning to a much greater extent, and could encourage industry planning and resource commitments to achieve the economies commensurate with long-term funding.

We have been encouraged that DOT has recently raised dollar thresholds for procurements requiring approval at the Departmental level, thus allowing the Administrator greater authority and flexibility in approving supplier contracts. This was a key concern and a suggested action in our testimony before this subcommittee in February 1980, and we are confident that these higher thresholds will contribute to time and dollar savings in the acquisition process. We believe that movement in the direction of still higher thresholds would further expedite the process of incorporating many of the essential improvements outlined in the modernization plan.

Despite our optimism about the potential of a fully-funded NAS Plan to address many of the current deficiencies in the national ATC network, we feel compelled to outline a final key concern which could severely impact and impede the success of the proposal. In view of the major systemic changes and expanded funding which has been proposed, will FAA be able to count on sufficient numbers of skilled technical and procurement personnel to implement its plan? Concerns have been raised that government-wide reductions in authorized personnel strengths may leave FAA seriously under-manned in engineering, management and key support areas. We urge continued Congressional attention and concern in this area, to assure that current budgetary savings are not achieved at the expense of a fully modernized air traffic system for the future.

In conclusion, we believe that the U.S. Air Traffic Control System is maintaining its record as the best in the world. It has been suggested that by expending $10 billion on the current plan, $25 billion in future savings will be realized through the consolidation of facilities and reductions in personnel levels needed to operate the system. We in EIA are dedicated to helping FAA realize these savings, while the nation continues to benefit from the safest Air Traffic Control System which modern technology can provide. To do this, we, the Congress, the industry and the FAA must act collectively, in a prompt and unambiguous manner, to ensure the application of our best resources towards this goal.

Mr. GLICKMAN. Thank you, Mr. McCloskey.

You mentioned this a little bit in the last part of your testimony. do you think the FAA has the ability to manage such a large system acquisition, not only the en route computers, but everything else that ties in there, and do you think they are going about it in the right way?

Mr. MCCLOSKEY. Well, I think the FAA has available to it the resources to do it. I think that between its own staff and the resources that it can hire outside, it can successfully manage the program. But I do think it takes careful planning, and I think it takes careful attention to the planning.

Mr. GLICKMAN. What do you think of the Office of Technology Assessment's idea of replacing the existing computers—if you have looked at this issue—the 9020A's with an interim hardware, the 9020D's, to gain kind of an interim needed capacity, and then waiting to modernize the en route system until the 1990's?

Mr. MCCLOSKEY. I personally haven't had a chance to look at the OTA proposal in depth, nor would I, in the normal course of events, do that as an association president. I can give you some of my own personal experience in terms of updating hardware as president of companies and president of the association. It is always a very difficult problem. It is hard because you have got an investment in software, and you need to liberate that software. It is hard because you have to make accommodations to future growth needs.

I think the real issue is recognizing what your problems are and being able to step up and do it. I have only had a brief chance to read some of the remarks that Dr. McLucas is going to make about that. I think there is no doubt in anybody's mind that you have got to go from the mid-1960's technologies to the technology that is available today. I think the thing that I recognized in his testimony was that we should not be adapting hardware that would somehow limit our software growth capability. And I would support the fact that we should not do that. I don't know that the hardware that was proposed would do that, so I don't know that the interim step would necessarily be necessary.

Mr. GLICKMAN. Mr. Dunn.

Mr. DUNN. Thank you, Mr. Chairman.

Included in this plan is the new TCAS system. We have heard from witnesses who said that the final cost of the TCAS for general aviation is around $2,500, and $50,000 for air transport. Several witnesses have questioned whether your industry can really meet those price ranges and the deadlines for actually developing that equipment as forecast in the FAA report. How does your industry feel? Can you meet those prices and those deadlines?

Mr. MCCLOSKEY. I am not in the position to answer that question. I think that is an issue for the individual vendors that are proposing systems to demonstrate their capability to do that within the price structure that they are quoting.

Mr. DUNN. OK. Thank you, Mr. Chairman.

Mr. GLICKMAN. Thank you very much for your testimony today.

Mr. MCCLOSKEY. Thank you, Mr. Chairman.

Mr. **Glickman**. Our next witness is Maj. Gen. Richard A. Burpee, Director of Operations for the Deputy Chief of Staff for Plans and Operations, U.S. Air Force.

General, it is a pleasure to have you here today. I think you have a statement and all of it will appear in the record. You may either read it or summarize it, depending upon your desire.

STATEMENT OF MAJ. GEN. RICHARD A. BURPEE, DIRECTOR OF OPERATIONS FOR THE DEPUTY CHIEF OF STAFF FOR PLANS AND OPERATIONS, U.S. AIR FORCE, DEPARTMENT OF DEFENSE; ACCOMPANIED BY MAJ. MICHAEL J. BALL, AIRSPACE AND AIR TRAFFIC SERVICES DIVISION, HEADQUARTERS, U.S. AIR FORCE

General **Burpee**. I would like to put it in as a matter of record and just have a brief statement.

Mr. **Glickman**. Sure. Your entire statement will appear in the record.

General **Burpee**. As you stated, Mr. Chairman, I am Gen. Richard Burpee, Air Force Director of Operations, and I do represent the Department of Defense this morning. On my right is Maj. Michael Ball, who is my FAA Action Officer.

The Department of Defense is unique as both a user and a provider of air traffic control. We support the intent of the NASP, and look forward to close cooperation with the FAA and the rest of the aviation community in further definition and eventual implementation of the improvements in the national airspace system.

The NASP discusses only FAA facilities and, obviously, changes to this FAA system will require changes in military air traffic control in their defense systems to insure continuation of our integrated common system that we now operate today. The national security task must be met, as we are all well aware.

Similarly, our airspace use is primarily for necessary training activities, which are often not well accommodated by the rigid instrument flight rule conditions, and various special arrangements exist today and must continue unless the NASP improvements can better support our unique needs.

The timing and scope of mandatory Mode S equipment is crucial since we must have access to the airspace and may be constrained by cost and other considerations. The FAA is aware of these concerns. Similarly, the transition from the joint surveillance to the new long-range radar system, the minimally attended radars, will be developed by a joint Air Force/FAA group. We also anticipate that the civil-military potential of the global positioning system will be validated in 1986.

So the Department of Defense is still a partner in providing airspace services as envisioned by the FAA Act of 1958, and we are also one of the major users of the FAA services. Our needs must continue to be met through close coordination on all levels.

I stop with that, and will be happy to try to answer any of your questions.

[The prepared statement of General Burpee follows:]

STATEMENT BY MAJ. GEN. R. A. BURPEE

Good __________. I am Major General Richard A. Burpee, Director of Operations, Headquarters United States Air Force. I have been asked to testify on behalf of the Department of Defense concerning the Federal Aviation Administration's (FAA) National Airspace System Plan (NASP). As the designated DOD representative on the Executive Committee of the FAA's National Airspace Review, as well as the alternate Air Force member of the DOD Advisory Committee on Federal Aviation, I am familiar with the airspace and air traffic control system modernization proposal by the FAA Administrator. In my position, I exercise staff supervision over flight operations as well as air defense and air traffic control services of the Air Force, and I work closely with the corresponding staff elements of the Army, Navy and Marines. I am speaking for all of the military aviation community when I say that, in DOD's unique position as both a user and a provider of air traffic services in the National Airspace System, we support the intent and general outlines of the NASP. We look forward to continued close cooperation between elements of the FAA staff and the rest of the aviation community in the further definition and eventual implementation of the improvements in the nation's airspace support system. These changes are required to accommodate the needs of the civil aviation community and national security.

The Congress recognized the need for a unified airspace system when the FAA was created in 1958, and it also recognized that national defense requirements created a special relationship between the military and the FAA. I would like to briefly

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comment on that special relationship prior to addressing some specific elements of the NASP.

As I previously mentioned, DOD is both a provider and a user of air traffic services. Although the FAA provides all en route and high-altitude services as well as approach control services for most of our military airfields, the DOD operates 51 approach control facilities as well as 180 air traffic control towers in the United States. These facilities provide us the necessary level of activity to train air traffic controllers for contingency and wartime needs and maintain an adequate rotational base so that military controllers do not spend their entire career overseas. Therefore, our air traffic control facilities serve a useful purpose in handling much of our traffic while providing a training base. They significantly reduce military traffic demand on FAA. Also, many civil airfields are provided air traffic services by military approach controls. Civil aircraft that pass through the airspace delegated to our military facilities by FAA are controlled by military controllers. Commonality of training and procedures as well as continuous local coordination results in a unified system in which pilots are generally not aware if their controller is wearing a uniform or not. This common system characteristic has, of course, been graphically demonstrated by the well-publicized loan of military controllers to augment specific FAA facilities since the August strike. What has not been so well publicized has been the expanded role taken on by military approach control facilities who have been delegated control of additional airspace. FAA's delegation of more airspace enabled DOD to handle more of our own traffic

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and also to assist more civil traffic in the expanded tower en route control program. We are refining these arrangements in daily coordination with FAA. The NASP upgrade, automation and consolidation of air traffic control facilities discusses only FAA facilities. Obviously, changes to the FAA systems will require changes in military systems to ensure continued interface and a continued common system philosophy providing ATC service to all users, civil or military. We are working closely with the FAA to further define the details of these interfaces and to assess the budgetary impacts on DOD. We will continue close cooperation as the various elements of the plan are implemented.

Now, I would like to discuss briefly the user aspect of DOD presence in the NAS. The Services fly over 5 1/4 million hours per year in the US. This is almost 10% of total flight activity in the United States. Although Army aviation (just under one million hours annually) is almost entirely helicopter and uses visual flight rules 95% of the time, the other Services emphasize IFR flight to the maximum extent practical for the remaining 4 1/4 million hours each year. There are three reasons. First, where air traffic control separation and advisory service can be provided, there is obviously an increased level of safety. Second, we train for all-weather capability and, consequently, must have the IFR service required for instrument flight operations. Finally, an IFR clearance is mandatory for operations in certain portions of the airspace. For example, IFR is mandatory for all operations above 18,000 feet. We must fly there to get proper aircraft handling for many types of training and also get the

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best fuel efficiency while en route to and from our training areas. As a result, we account for a significantly higher proportion of air traffic services than our flying hours or numbers of aircraft would indicate. In this way, we are somewhat similar to commercial air carrier operations.

But that is only a surface similarity. The main purpose of commercial aviation is, as stated in the NASP, efficient transportation. On the contrary, DOD's requirements are primarily for training to use aircraft for military tasks associated with the defense of our Nation. As a result, most of our flying is the opposite of predictable, point-to-point commercial flights. In many cases the rigidity of the IFR system does not permit an acceptable level of training, so various special arrangements have been made to accommodate our training operations in the system. These will continue to be required under the improvements proposed by the NASP. Special arrangements also exist to enhance the safety of our VFR operations. We will work hard during the National Airspace Review to ensure that procedural and/or equipment changes will continue to accommodate special airspace requirements of the Armed Forces.

I would like to give one specific example. The military services must train our aviators in low-level penetration tactics and, for helicopters, nap of the earth flight. The mutual goal of DOD and FAA has been to accommodate these essential training flights within a system of specified military training routes or within special areas, ideally under the watchful eye of air

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traffic control. In previous testimony to this committee in 1977 Mr Stoney, of the Office of the Director of Defense Research and Engineering, identified the regime below 10,000 feet as the primary area in which DOD looked for air traffic control system improvements. This is still a valid requirement. Due to various constraints, the current system only has adequate surveillance and communication coverage to provide IFR service to about half of our 480 high speed, low level military training routes. To enhance the see and avoid principle on the routes which must be flown VFR, the military provides tremendous amounts of information to FAA so that flight service stations can inform VFR general aviation pilots of our activities. The current manual system makes such information dissemination cumbersome and less effective. We are confident that the increased automation, networking, and data link services envisioned in the NASP, can improve this information transfer where IFR air traffic control service is not feasible.

This is only one example of the possibilities. I am sure that the National Airspace Review will evaluate many alternatives prior to the final implementation of the NASP.

There are some other specific points about the NASP that I would like to address.

First, as is stated in the NASP, the ultimate limiting factor on the nation's air transportation system is concrete--the runways available. The DOD recognizes its responsibilities to the economic well-being of the nation and has always been willing to share use of military runways when feasible. In fact, we have a special

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task group that meets regularly with the FAA and is the focal point for discussions concerning joint use of civil and military airfields.

Second, as I stated earlier, the DOD is an integral working part of the national air traffic control system. Although the FAA has the statutory responsibility to provide a common system for all users, the DOD also has a valid requirement to maintain a level of air traffic control capability to meet wartime readiness requirements in support of our national interests. It is very difficult to maintain system integrity when the budgets for various elements of the system are spread among several agencies.

My third point concerns the envisioned increase in automation of air traffic control. As Mr Stoney pointed out in his earlier testimony and as I mentioned, the rigid structure of the IFR system is often incompatible with military requirements to maneuver in a random, unpredictable tactical training manner in the airspace. In fact, one of the most difficult automation tasks is to develop a tracker which can handle multiple maneuvering fighter aircraft training in air combat tactics. We feel that the FAA enhanced automation software effort may provide for more effective real-time joint use of airspace while still permitting us the flexibility to train the way we plan to fight. We will continue to work closely with the FAA to ensure that our requirements are clearly understood in addition to those civil needs laid out in the NASP.

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There are several other areas in the NASP that are also of concern to us. First, in new technology, the decision to implement Mode S secondary radar with its attendant data link and consequent phaseout of primary radar for en route air traffic control will impact the avionics fit of our 20,000 DOD aircraft. Estimated costs for this are in excess of one billion dollars. Changeover to Mode S also impacts the air defense role of the Air Force in which we are currently assisted by the FAA. The timing of any mandatory equipage with Mode S will be crucial since we must have access to the airspace but will be constrained by cost and other considerations. The FAA is aware of these concerns and is working with us in this endeavor. Similarly, the details of transition from the Joint Surveillance System to a new surveillance system will be developed by the existing Joint Radar Planning Group which reviews how air defense surveillance requirements are met. The Nation must be assured of protection by detection of unidentified aircraft penetrating or operating in our airspace.

Finally, we support the FAA position that some continuation of reliance on ground-based navigational systems such as VOR-DME and TACAN will be needed as we evolve toward the potential benefits of a satellite-based navigation system--the Global Positioning System. We anticipate that the national decisions envisioned for 1986 by the Federal Radio-Navigation Plan will validate our confidence in the civil-military potential of GPS. The NASP proposed interim reliance on ground-based aids must be paced to allow adequate evaluation prior to evolving into satellite navigation for all but precision final approach. We in the DOD

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feel that the GPS will ultimately play a major role in the National Airspace System.

We will continue to participate actively with the FAA and the National Weather Service in implementing the integrated NEXRAD weather radar program.

In summation, the DOD is very much a partner with FAA in providing air traffic services as was envisioned in the FAA Act of 1958. We are one of the major users of FAA services and have unique requirements. We are also unique since we provide ATC. Our needs will continue to be met through close coordination on implementation of the NASP and by a very active participation in the NAR. We must continue to ensure system integrity--military ATC facilities and navaids must continue to be fully integrated as part of the NAS. We must have improvements in accountability of low-level VFR traffic. The potential for automated information dissemination to extend the utility of visual flight rules is very important. Unique training requirements of DOD which cannot be fully accommodated by an automated system must still receive special consideration, and the role of primary radars in the air defense mission will remain valid until a suitable replacement can be developed.

Thank you for giving me this opportunity to express the Department of Defense views on the NASP.

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Mr. **Glickman**. Do you believe that you have had adequate input into the development of this plan?

General **Burpee**. Mr. Chairman, I guess in a word, we were not a partner in developing the national airspace system plan. We picked up a word from the FAA at the Action Officer level in about December that there was a plan being developed. We formally were not notified in the Department of Defense until January of this year, when the FAA came over to the Department of Defense and gave us a complete briefing on the plan. Then, of course, around January 29, Mr. Helms made the plan public and we received the actual plan and had a chance to look at it.

Mr. **Glickman**. Have you made any formal comments, written comments, to the FAA on concerns that you have in the plan?

General **Burpee**. Dr. DeLauer has sent a letter, I think, about March, right after he received the plan. He commented that he was concerned about the cost if we had to go to the Mode S system. The cost he said estimated somewhere in excess of $1 billion. That comment has been sent over to the FAA.

Also, Dr. Keel, who is the Assistant Secretary in the Air Force for Research, Logistics, and Acquisitions, sent a letter saying that they were concerned about some of the cost issues, but that we did support the plan and we were happy to work with them.

Mr. **Glickman**. Do you think there is any way the committee could get copies of that correspondence?

General **Burpee**. They are public, I guess.

Mr. **Glickman**. I think it would be useful for our record.

General **Burpee**. We could make those a matter of record.

Mr. **Glickman**. There is nothing that is classified in those?

General **Burpee**. No.

[The information follows:]

THE UNDER SECRETARY OF DEFENSE

WASHINGTON DC 20301

RESEARCH AND
ENGINEERING

1 MAR 1982

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Dear Mr. Helms:

The DoD has received advance copies of your December 1981 National Airspace System Plan and we are in the process of a thorough review of your very comprehensive document. Although our review is not yet complete, my initial impression is that your plan could have a major impact on the DoD.

I have noted that you plan to mandate a Mode S transponder for all aircraft flying above 12,500 feet by 1990. It is my understanding that the FAA and DoD were maintaining a close liaison in the development of the Discrete Address Beacon System (DABS), Mode S's predecessor. From our contacts with your staff, we understood that equipage with the DABS transponder would be voluntary. Under these circumstances, our intent, which we have stated in Congressional testimony, was to couple the DABS transponder development with our next generation IFF program and to equip DoD aircraft with an integrated DABS/IFF capability as we replaced the current generation air traffic control beacon IFF transponders.

Your plan would necessitate an accelerated Mode S development and a major procurement and aircraft modification program on a schedule independent of our IFF improvements. Preliminary estimates for equipping all DoD aircraft with Mode S range upwards of $1 billion. I have serious reservations whether Congress would approve a billion dollar DoD expenditure with no commensurate improvement in our warfighting capability.

I recognize your dilemma in convincing a reluctant aviation community to endorse new ideas that require additional capital outlays. Nevertheless, I am concerned that the FAA would change its position on an issue with such major impact on DoD without prior consultation with us.

I would hope that we could reach a mutually agreeable accommodation on Mode S; my staff and I are ready to work toward this end with you and your staff.

Sincerely,

Dick

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OFFICE OF THE SECRETARY OF DEFENSE

WASHINGTON DC 20301

APR 20 1982

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, DC 20591

Dear Mr. Helms: Lynn ——

Over the past few weeks the DOD has been reviewing the National Airspace System Plan (NASP) to consider its impact on military flight activities and air traffic services. Frankly, we are impressed with the plan's comprehensiveness; it reflects the magnitude and intensity of the effort which went into its development.

Although the plan does not highlight the unique role of the DOD, both as a user of National Airspace and as a provider of air traffic services to civil as well as military aircraft, the DOD supports the intent of NASP to improve the productivity and efficiency of air traffic services to the aviation community. As the implementation of the plan progresses, close cooperation between our agencies will be necessary to assess the programming and funding necessary to interface our respective operations.

Our initial review has already indicated some specific areas which require clarification and active DOD participation with FAA. Accordingly, our staffs have already been in contact with each other.

In summary, the DOD endorses the FAA's effort to improve overall operations in the National Airspace and looks forward to a continuing close cooperative effort to work out implementing details which will support the needs of our Nation's defense interests.

Sincerely,

ALTON G. KEEL, JR.
DOD Representative
to FAA

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Mr. **Glickman**. You were talking about the problems of being covered by the mandatory Mode S by 1990 is what has concerned you in terms of the costs involved.

General **Burpee**. Yes.

Mr. **Glickman**. Is there anything else offhand that you could find that would be incompatible between your requirements and the NAS requirements?

General **Burpee**. Of course, the cost factor would be a big factor. But, operationally, the national airspace system plan is designed for a point-to-point type flight effort, primarily commercial aviation. The Department of Defense needs are more in the line of going to an operational area—we call them now military operational areas, restricted areas, and so on—and we traverse in the upper flight structure. In this case, in the national airspace system, we would be above 12,000 feet. If we were doing fighter tactics or training tactics, acrobatic maneuvers, this type of thing for our training, then, as we see this plan, if it can accommodate that, then it would be compatible; if it cannot do that, then it would be incompatible.

There is one other point I might make. One of our big concerns in the military is coverage below the 12,000 feet, and eventually the 6,000 feet. Most of our exposure to accidents occur and our exposure to general aviation aircraft occur below those levels. And we would have liked to have had some kind of warning or separation or some kind of confidence in a plan that would give us that capability.

Mr. **Glickman**. OK. Going back to the Mode S, are you aware at this stage if there is any compromise on the Mode S issue that DOD could live with?

General **Burpee**. Well, we have our Mark 12 IFF sets now that we are living with at the FAA. I guess, in the long term, if we programed the Mode S operation in our aircraft, we would live with it, but it is going to have to be some time out.

Mr. **Glickman**. One final question: It is my understanding that DOD has chosen to upgrade their existing software rather than replace the existing computer equipment on the worldwide military command and control system. We also understand that this system is experiencing automatic data processing problems.

Would you say that this background would tend to support the position taken by the FAA to replace the hardware in the NAS Plan, as opposed to some sort of interim step?

General **Burpee**. I am familiar with the worldwide information system, but I am not familiar with the kind of problems they are having.

Mr. **Glickman**. OK, very good.

Mr. Dunn.

Mr. **Dunn**. I would like to switch the subject a little bit and talk about air safety, which the report sort of addresses.

The Air Force does a couple of things differently than the FAA system, one of the things being runway light length markers. Is the Air Force still committed to that as a vehicle for safety?

General **Burpee**. The runway markers?

Mr. **Dunn**. Yes.

General **Burpee**. Yes, sir, we sure are.

Mr. DUNN. I had the experience last month of transisting in and out of the FAA system, landing at Patrick Air Force Base getting into your system. I would have to say, based on my experience of that 1 day there, that there is very little problem from transisting between the two systems and landing at one of your bases.

In the other area, can you explain how the Air Force differs from the FAA in requirements for deicing aircraft?

General BURPEE. I am not familiar with the FAA requirements. The Air Force requirements are that we will certainly not take off with any ice on the wings.

Mr. DUNN. Period?

General BURPEE. Period.

Mr. DUNN. No exceptions?

General BURPEE. That is right.

Mr. DUNN. How do you maintain that?

General BURPEE. That is a judgment by the pilot.

Mr. DUNN. The point I am trying to get at is I think the Air Force is much more cautious in total capabilities per aircraft takeoff than the FAA.

General BURPEE. Yes.

Mr. DUNN. An example I would use is that when I was starting my two engines in my aircraft, there was a guy standing there with a fire extinguisher. And the thousands of times I started my engines at a regular airport, I have never seen anybody standing there with a fire extinguisher. That is just standard procedure any time you fire up an aircraft engine.

General BURPEE. That is right.

Mr. DUNN. How would you determine from the time, on an inclement weather day, that aircraft rolls out of the gate until takeoff whether it has or has not picked up ice on its wings? Is there any particular procedure for that?

General BURPEE. In small aircraft, of course, you can just look out and see the buildup on the wings. On large aircraft, we have scanners, and the scanners will let the pilot know whether he has any kind of accumulation. If he has any accumulation, then he will terminate his takeoff and go back and get deiced.

Mr. DUNN. Isn't it also true that at the threshold at the end of the taxiway and the start of the runway, you have a guy sitting there in a truck that can tell that pilot whether there are any problems with that aircraft at all, whether it be icing or whatever?

General BURPEE. That is true. In our tactical fighters, we have what we call a hot check area, which they pull into. They do other things besides check for ice. They generally check the aircraft over completely and pull out the necessary safety pins for ordnance and this type of tying, but they look over the tires, they check the panels and they check the aircraft in general. They are in ground radio contact with the pilot while they are doing that.

Mr. DUNN. Several months ago, I had the experience of flying with the F-15 group down in Virginia, and that is the exact procedure I am talking about. Four of us took off together, and there was a man who went over every one of those aircraft before we rolled out on the active runway. To my knowledge, none of those pilots felt that their ability to be pilot in command was in any way detracted from just because someone had given them a final check.

General **Burpee**. That is right.

Mr. **Dunn**. When I proposed at this committee a very similar procedure, limited to even deicing, the Airline Pilots Association said that this was taking away our right to be pilot in command.

The Air Force would disagree with that statement?

General **Burpee**. Well, I can't comment on what the Airline Pilots Association position might be.

Mr. **Dunn**. Let me rephrase that. An Air Force pilot who is about to take off and moves from taxiing mode into the runway doesn't feel that because there is some guy checking over his aircraft that he is any less of a pilot?

General **Burpee**. No. The way it works is, when he is on the headset with the pilot, he will tell him the condition of the airplane.

Mr. **Dunn**. Yes, sir.

General **Burpee**. And the pilot makes the judgment whether he should take it or not take it.

Mr. **Dunn**. My reaction, sitting in the back seat of that F-15, is that the young pilot was grateful that that man was giving him a final check.

General **Burpee**. In large aircraft, I am pleased——

Mr. **Dunn**. In large aircraft, it is a big difference. You can't even tell the condition of that aircraft.

General **Burpee**. That is right. I have had some experience with ice in a KC-135 operation, McConnell, as a matter of fact. We do our normal procedures, and then we check the aircraft, as you said, before we take off with a "supervisor of flying," as we call them, or an independent observer.

Mr. **Dunn**. I don't want to put words in your mouth, so I will phrase this very carefully. In your opinion, the Air Force does more to insure, at the point that an aircraft rolls out on the runway, that that aircraft is fit to fly than the FAA?

General **Burpee**. Let me say this: We take every precaution that we can in the Air Force to make the airplane fit for flight before we take off.

Mr. **Dunn**. I thank you, sir.

Mr. **Glickman**. General, we appreciate your testimony today very much.

If you could try to get us copies of that correspondence on the NAS plan, we sure would appreciate it.

General **Burpee**. We sure will.

Mr. **Glickman**. The next witness is Martin L. Ernst, the vice president of Arthur D. Little, Inc.

Mr. Ernst, it is a pleasure to have you here. Your entire statement will appear in the record, so you may feel free to summarize as you deem appropriate.

STATEMENT OF MARTIN L. ERNST, VICE PRESIDENT, ARTHUR D. LITTLE, INC.

Mr. **Ernst**. I will summarize it, emphasizing points that I believe are of particular relevance to this hearing.

I might note that I am here more as an individual than as a representative of an organization that has established a position regarding the FAA national airspace system plan. I believe my invitation was based partly on work that I and my company have done over many years concerning the introduction of new computer information systems, and partly because I have had on and off working contact with air traffic control problems from the late 1940's.

My most recent experience was between September 1979, and a little over a year ago, when I was in charge of an assignment that Arthur D. Little had to help the FAA in its very early planning for replacing the en route air traffic control computer complex. I became familiar with some of the projects incorporated in the national airspace system plan at that time, but mainly in terms of how they would influence planning for the replacement system.

Since that assignment ended, many events have occurred, some of which have changed FAA requirements and priorities. There are many aspects of the FAA plan about which I know very little. Therefore, I want to confine my comments to the managerial aspects of the proposed program to replace the air traffic control computer and display complex and to the impacts of developing computer technologies as they apply to this program.

One of the first points I want to make is that the FAA has very stringent constraints and requirements for this program. The existing system is very large and very complex; and it has undergone many improvements over the course of its life. It is not an easy job to replace a major computer system. Furthermore, the new system is going to have to grow in the future, and part of the growth will involve increased complexity—such as for handling commuter traffic and for achieving greater aircraft fuel efficiency, as well as increasing flight safety.

The safety requirements themselves force the system to have a lot of equipment redundancy as well as a sense of preplanned fallback procedures. There are very few types of computer systems that must operate as continuously as the air traffic control system, essentially 24 hours a day, 365 days a year. Most systems can cease operations for at least brief periods during reequipping and retraining, but that is a luxury that air traffic control cannot count on.

Furthermore, at the time the transition is made, there can be no significant changes in the kinds of procedures used. There are too many pilots and controllers involved, so changes must be made only slowly and there must be a kind of transparency to the transition from the old to the new system. We must start off with the existing system, its strengths and its weaknesses and we must remember the lessons that were learned in the process of building it.

There are two views about which I feel very strongly. First, this replacement program is not one in which new equipment and software can be installed, live out its life, and then be replaced again. This doesn't mean that we should ignore life-cycle design and cost considerations; it simply recognizes the fact that the larger the system becomes, the more difficult and expensive it is to replace it completely. I strongly believe one of the goals of the program should be to develop a system that will be capable of steady evolution and incremental growth afterwards, so that it will not again obsolesce as a unit.

Second, I don't think we are in a position where we can seek to design the ideal system. There are a lot of practical considerations that require us to look for the best system possible, not the best possible system.

One of the reasons for this is the fact that computer hardware has changed rapidly over the years and will continue to change in the future. I have brought a few slides to illustrate this because it is important to understand the nature and extent of likely changes.

[Slide 1.]

We have been accustomed in the past to viewing large computing resources as being provided by one or more monolithic devices. Our belief is that, in the late 1980's, the kind of architecture shown on this slide will dominate most large computer installations. The single large computer will be replaced by a set of two, four, six, or even more, separate computers/processors linked by high-speed communications buses. Some of the individual computers will be specialized for functions such as input-output or for accessing the main storage system. Some of them will be general purpose processors, each with some memory storage of its own, but calling on the main file processor when access to more massive memory is necessary.

There may be other specialized processors which could have application in the FAA for radar data processing or for generating automation aids for controllers. Finally, there is a supervisory processor that exercises control over the entire system.

[Slide 2.]

We don't believe even this type of architecture will be the most advanced by the end of this century. An illustration of what is likely to evolve is shown on the second slide. This slide is based on published information from the Japanese, but we have reasons to believe many American manufacturers are thinking along the same lines.

The main point I would like to make here is that the external interface, the languages, the kinds of software, and the entire organization of the system will be subject to change. I think that FAA planning must be done with recognition of the fact that these kinds of changes will be going on continually for several more decades.

The situation has some mitigating features from the point of view of planning, however, because the computer manufacturers recognize that their users have huge investments in existing software. They will lose sales if they change too rapidly. So they try to build compatibility into their equipment as they move from one computer architecture to another.

One of the most widely discussed features of modern computer systems is the trend toward distributed processing. There are two kinds of distributed processing; and there often is confusion when people talk about the subject as to whether they mean geographic or functional distribution. The first diagram I showed had a central processing installation with a functionally distributed processing load.

There also can be geographic processing distribution, which arises when intelligence is built into remote terminals, or when there are computers at different locations that are linked together to perform a set of functions. I would like to point out that the existing FAA system already has some functional distribution, in that separate computers are used for the main processing load and for driving the display systems.

On the software side, there also are a lot of changes underway. A major thrust here is to develop techniques whereby software is programmed in a modular form and with a data independent structure in the individual modules. One reason for this type of software design is that it will improve ability to move from one kind of hardware architecture to another.

The key characteristics of the technology background are simply that things are going to keep changing, and they will do so fairly rapidly. This, again, emphasizes the need to get into an evolutionary posture.

In general, the developments in computer hardware and software are favorable to the broad requirements of the FAA. Distributed systems using a bus architecture have a considerable degree of inherent modularity which is a good way to deal with both future growth potential and the redundancy needed for safety.

The criticality of language selection has declined somewhat and the newer software designs, if executed properly, will adapt well to change and permit a great deal of future growth. To be executed properly, however, time must be available to do the job well. In the past, the FAA, under time pressures, tried to take some shortcuts while developing the current system. I believe this led to more complex software than otherwise would have been necessary.

I don't know all the reasoning that entered the FAA decision to use a two-step system replacement process, but I believe the plan was aimed at being a conservative one. The rehosting of software can be a very tricky process, but once it is done, it assures adequate capacity to provide time for the careful development of new software. I believe this is critical in the long run; software development is the most difficult part of the overall plan and has the greatest uncertainties.

I have no basis for saying that the proposed plan either is or is not the optimum one. I believe it is an entirely reasonable one, and that there is no reason that it can't incorporate sufficient choice and flexibility to insure that no major technological possibilities need be discarded.

In the last analysis, I believe the quality and the cost effectiveness of the replacement program will depend more on the quality of the program management than on any other single factor. To my mind, the main need now is to carry it out with reasonable dispatch, with great care, and under conditions where full attention can be devoted to building a system suitable for the future rather than worrying about crises that deal with holding together the existing system.

[The prepared statement of Mr. Ernst follows:]

TESTIMONY OF MARTIN L. ERNST

HEARING ON FAA NATIONAL AIRSPACE SYSTEM PLAN - APRIL 29, 1982
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

My name is Martin L. Ernst. I am Vice President, Management Sciences at the research and consulting firm of Arthur D. Little, Inc. In this capacity, I oversee the work of those sections of the company devoted to computer technology, information systems, operations research and systems analysis. In addition to these responsibilities, I have personally been involved in professional case work concentrating on the business, management, social and economic trends and consequences of the rapid developments in computers and telecommunications and their interrelationships.

From September 1979 to Spring 1981, I was in charge of Arthur D. Little's assignment to assist the FAA in its early planning for a program to replace its En Route Air Traffic Control Computer and Display Complex. During this work, I became familiar with many of the projects in the National Airspace System Plan. This familarity was only for the purpose of assuring that the eventual computer complex program plan would be able to accommodate the equipment and systems being developed in these projects; it did not involve detailed study of the projects themselves.

Since the completion of that assignment, many events have occurred. Some of these, such as the PATCO strike, obviously have influenced current requirements and priorities.

The FAA recently prepared a cohesive long-range plan for the utilization of U.S. airspace. It is described in the National Airspace System Plan which provides a context for more integrated planning than was available previously. While I have examined the plan, I make no claim to being qualified to testify on many of its details. I will, therefore, concentrate on the area I know best--the program managerial implications of: (1) the current situation facing the FAA and the requirements and contraints involved in successful conduct of a program to replace the main air traffic control computer and display complex; and (2) the impacts of developing computer technologies as they apply to this program.

In the following material I will discuss:

> The stringent environment in which the air traffic control system must operate, and how this environment influences the replacement program's goals and procedures;
>
> Developments and expectations with regard to future computer hardware and software technology, with particular emphasis on the growth of what are called distributed processing systems; and
>
> The current FAA replacement plan, and the extent to which it takes full advantage of the technological developments just described.

GENERAL PROGRAM REQUIREMENTS

To understand how the status of computer technology can influence the replacement program, it is important to examine the requirements facing the FAA in terms of both what has to be done and how it must be done. In brief, the following considerations are the most important:

1. Size

The FAA air traffic control operations employ by far the largest nonmilitary configuration of real-time computer resources operated by the U.S. Government. In fact, the system is the largest of its kind in the world. Its replacement, therefore, is a major government undertaking.

2. Complexity

The system is not only large but also complex in terms of the functions in performs now and the functions it will be desirable to have it perform in the future. The present system has always had to incorporate changes as needs arose and as steady improvements in the safety of air traffic control successively uncovered new possibilities for still further increasing that safety. Other changes have been made for social purposes, such as routing takeoffs and landings to meet noise abatement restrictions. Traffic densities around airports have grown steadily as aircraft operations have increased more rapidly than have the number of major city airports, and this has increased the complexity of conducting safe control operations.

3. Growth

Like many government activities, FAA air traffic control is expected to be responsive to social and economic needs. While traffic can be restricted for the sake of safety, restrictions that are more than temporary must be regarded as a failure of the FAA to fulfill completely its mission (provided that managing additional traffic is both technically and economically feasible--there always will be an upper limit). Increases in traffic handling capability must be anticipated as air traffic coninues to grow. The complexity of operations also will increase if or when new types of aircraft, such as commuter STOL (Short Takeoff and Landing) come into use, or for the sake of improving aircraft fuel efficiency and schedule adherence.

4. Safety

Safety, of course, is the dominant concern of the air traffic control system and has major implications on the technology employed. All important types of equipment must have some degree of redundancy to protect against failure. Fallback procedures must be available in a form that, in combination with temporary flight restrictions and diversions, will permit gradual safe transition from full operations to whatever level remains feasible. All of these subjects have been of direct concern to the Congress for many years.

5. Continuity of Operations

Very few types of computer operations must provide absolute continuous service for essentially 24 hours a day and 365 days a year. Even important military systems can usually stand down units, one at a time, while they are re-equipped and retrained. The air traffic control system cannot afford this luxury; during the replacement process, its centers can be down for only very brief periods that are planned well in advance.

Another type of continuity derives from the need to change procedures only incrementally. The user population of controllers and pilots cannot accept large numbers of procedural changes at one time, without lowering the safety level; thus "transparency" of operations is necessary during the replacement transition, with new capabilities being added only gradually thereafter.

6. Internal Coordination

Most large equipment programs require direct and detailed participation by only limited parts of the organizations within which they take place. Major military programs, for example, are likley to require intensive involvement by only a small fraction of the branch of service affected, with relatively simple and clear-cut interfaces with other service activities. However, the case of the FAA, where air traffic control is by far the major function performed in terms of manpower and effort, program planning must be done in the context of continuing coordination with the on-going activities of a very large fraction of the FAA organization.

7. Heritage

The starting point for the re-equipment program must be the present system, with its existing strengths and weaknesses and with recognition of the lessons learned during its development and use. The current system has been a highly effective one that has served air transportation extremely well. During its life it has demonstrated an ability to handle major growth in operations while providing a steady decline in accident statistics. While it probably could be continued for some time by effecting a large number of "fixes" and minor additions, this should be regarded as, at best, a "fall-back" approach. It will divert effort from the main thrust of thoroughly modernizing the system for the long run, and many of the fixes and additions required would have only a short life. For many reasons, a new system is needed; and, if anything, the current program is starting later than desirable.

Other lessons can be learned from the system's history. In particular:

The equipment on which the heart of the present system is based employs IBM 360 series computer technology and architecture. This series first reached the market in 1965; the FAA equipment was installed in the 1970's; and these computers must continue in use until at least 1985. This is a long life given the dynamic technology involved. While it may not be desirable or necessary to duplicate this life span in the new system, the experience points up an important management consideration: assuring that the new equipment will be supported by the original manufacturer, or by an acceptable alternative, over an extended period.

The programming language chosen for the current system (called (JOVIAL) was believed to be a language that would be strongly supported and widely used at the time it was selected. This has not been the case. As a result, the FAA has faced extra difficulties (and costs) in operating with a little-used and, therefore, a quickly obsolescing language. Language selection is likely to be a less difficult and critical decision in the future. However, software design (commonly referred to as "architecture") will replace language in importance. The choices made in this area will be critical to the long-term health of the replacement system.

> Finally, when development of the current system began, efforts were made to employ the best means for organizing and managing software development. However, a variety of time and other pressures eventually led to violations of the original software management practices. The price has been unusually complex software that is difficult to modify or to add new applications that interact with existing programs or data. Software management prctices have improved over the years. However, to assure that they are employed effectively, care must be taken to avoid unreasonable time pressures that would encourage or force shortcuts. This has implications for the approach employed, since it requires that capacity pressures not unduly influence the pace of work.

From these lessons, it is clear that the replacement program is a difficult task. While it does not, and should not for safety reasons, require reliance on leading edge state-of-the-art technology, it is subject to a variety of operational constraints that place very stringent requirements on management. Overall, I believe two broad conclusions can be drawn:

> First, the replacement program should not be viewed simply as one in which new equipment is installed, lives out its useful life and is then replaced. This statement does not mean that life cycle design and cost considerations should be ignored. Rather it seeks to emphasize the fact that the larger a system grows, the more difficult and expensive it becomes to replace completely. One of the goals of the program, therefore, should be to develop a system that will be capable of steady incremental evolution, so that it will not obsolesce as a unit but can move in a pattern of continuing modernization.
>
> Second, we cannot afford to seek what would be the "ideal" or best possible system on a conceptual or abstract basis. Practical considerations require that what should be sought instead is the

best system possible, given the starting point and the many requirements and constraints.

EVOLVING COMPUTER TECHNOLOGY

Because the replacement system will employ new equipment and software, consideration must be given to what is happening in these areas. The rapid growth and increased capability that have characterized computer technology are almost certain to continue for several more decades. This, of course, complicates planning by increasing the uncertainty of how well solutions to near-term needs will accommodate future developments.

In the hardware area, two issues must be faced. The first is the most important and immediate and concerns the extent to which distributed--as opposed to centralized--data processing should be employed in the replacement system. Distributed processing systems have been evolving for some time; they are well understood, and the likely near-term architectures for such systems are well known. In the longer term--that is, in the 1990s--totally new architectures are likely to evolve. These are too far off to impact immediate equipment decisions, but they can influence software architecture decisions.

The software area also has two important aspects. First, we expect that the past pattern of growth in software costs, relative to hardware costs, will continue well into the future. Second, because the investments made by industry and government in existing software are enormous, they already are influencing both the equipment that hardware manufacturers are providing and the practices employed in developing software. Manufacturers cannot market their products to many users if the new equipment will force these users to rewrite major portions of their existing software. This has encouraged the design of more flexible software that can be shifted from one hardware architecture to another, and thus be capable of using improved computers as they become available.

1. Hardware Architecture

A major growth area in computer hardware has been in distributed processing. However, it is important to note that no single sharp division exists between distributed and centralized data processing. Instead there is a spectrum of possibilities:

There are purely centralized systems, used entirely for batch processing with either direct or remote entry.

There are on-line systems that employ terminals which have no "intelligence," but are simply data entry or retrieval points. These also can be considered centralized systems.

More commonly, there are on-line systems with terminals that incorporate limited intelligence and memory, mainly used to perform editing of input data and other minor functions.

There is a growing line of terminal products that are in themselves complete microcomputers with some memory storage of their own. These terminals are able to perform many functions on their own and refer to a central processor only when necessary.

There are terminal systems which connect to a local minicomputer that normally will service a number of terminals. The minicomputer, in turn, can access a larger computer either for data stored in a large memory bank or for use of greater processing capabilities.

Finally, the large central computer systems, themselves, need no longer be based on a single piece of processing equipment (usually called a mainframe) but can be built as a combination of separate general purpose and specialized individual processors connected by buses (e.g., high-capacity links to communicate data or control information between the individual processors). Therefore, a centralized installation can itself distribute the workload among multiple processors. This, in fact, is characteristic to a limited extent of the present FAA system with its separate computers for main processing and display processing.

The type of large central computer systems we believe will come into increasing use in the latter half of the 1980s is illustrated in Figure 1 which shows six separate processors connected by a bus for transmitting data and a bus for transmitting control instructions. These processors will be located either in the same room or close enough together to connect to the same buses.

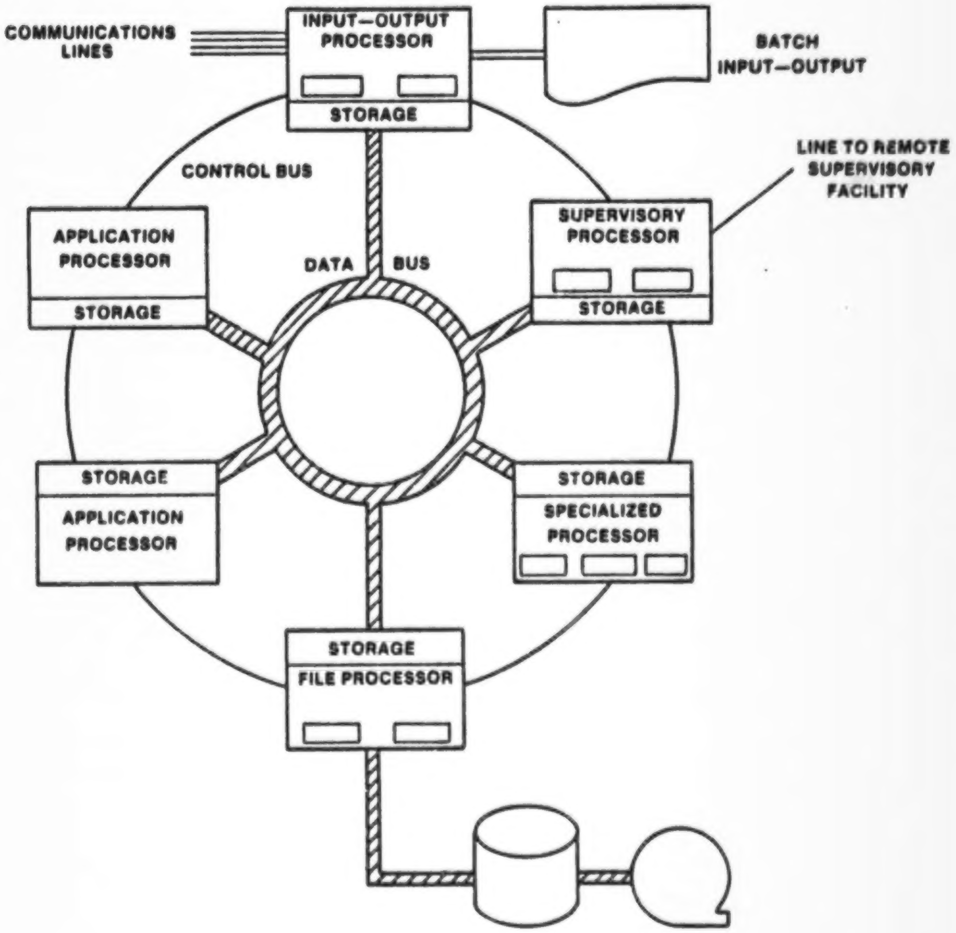
Two of the processors shown are general purpose. Each has its own memory storage, which can be organized to have its contents modified on the basis of its current activity so as to minimize the need to access the main data bank via the data bus.

A third processor is indicated as being specialized--that is, it is designed to be highly efficient in performing a particular function, such as radar signal processing. It also has its own associated storage.

Three other specialized processors, again designed to be as efficient as possible for their particular activities, are concerned with: (1) input and output of data and information; (2) file processing, which involves accessing the large data base that contains complete files of non-volatile information for the entire system; and (3) a supervisory processor, which exercises management and control over the entire complex. All three of these processors can have built-in multiple computing elements, which normally will be performing exactly the same kinds of tasks. This form of redundancy provides a "fail-soft" capability since, if one of the computing elements fails, the others can continue and the processor as a whole simply will work somewhat slower. And the supervisory processor can have a link to pass information to, and receive instructions from, a still higher supervisory function.

Figure 1

FUTURE GENERAL-PURPOSE COMPUTER SYSTEM


COMMUNICATIONS LINES
INPUT—OUTPUT PROCESSOR
STORAGE
BATCH INPUT—OUTPUT
LINE TO REMOTE SUPERVISORY FACILITY
CONTROL BUS
APPLICATION PROCESSOR
STORAGE
DATA
BUS
SUPERVISORY PROCESSOR
STORAGE
STORAGE
APPLICATION PROCESSOR
STORAGE
SPECIALIZED PROCESSOR
STORAGE
FILE PROCESSOR

Best Available Copy

The entire central system shown in the diagram can be associated with distributed miniprocessors, or with terminals that have their own built-in intelligence. This combination provides a functionally distributed central system and what can be a geographically distributed overall system.

The diagram is examplary only and is not intended to imply direct applicability to air traffic control. It illustrates the flexibility that we anticipate in future designs and the capability that will be available for tailoring a configuration to the needs of a user.

Such flexibility is not obtained without a price. Since communications via the bus take more time than communications within a single large mainframe, the computing capacity of the system is lowered somewhat. The slower speed is one of the reasons why manufacturers have tended to be slow in providing this type of architecture. They have been waiting for improvements to be made in the underlying (very large-scale integrated circuit) chip technology that will compensate for the speed loss. An additional reason is that the users of very high capacity equipment generally are large organizations with major investments in existing software, and this software often is based on designs that are not immediately compatible with the bus-type of equipment configuration. A gradual transition, allowing time to prepare more flexible software, is viewed by vendors as more acceptable from a marketing point of view.

Very large mainframe systems will still be built since they have certain advantages over distributed systems. For example, they are superior for: (1) very large batch-processing activities, where they achieve greater efficienty than distributed systems in managing the large numbers of input and output peripheral equipment units that are needed; (2) very intensive "number crunching" operations, such as for some types of scientific and image processing activities; and (3) management of very large data bases that for one reason or another have to remain centralized. Except where these types of requirements apply, however, we anticipate transition to more distributed processing. The distributed systems tend to provide more selectivity in balancing among the desirable attributes of economy, reliability, flexibility and local control, and this selectivity is very appealing to most users.

Sometime in the 1990s, we expect that this type of architecture will begin to be replaced by a new and quite different approach. A possible fifth generation architecture, shown on Figure 2, is based on descriptions emanating from the Japanese who have been studying the subject quite extensively.

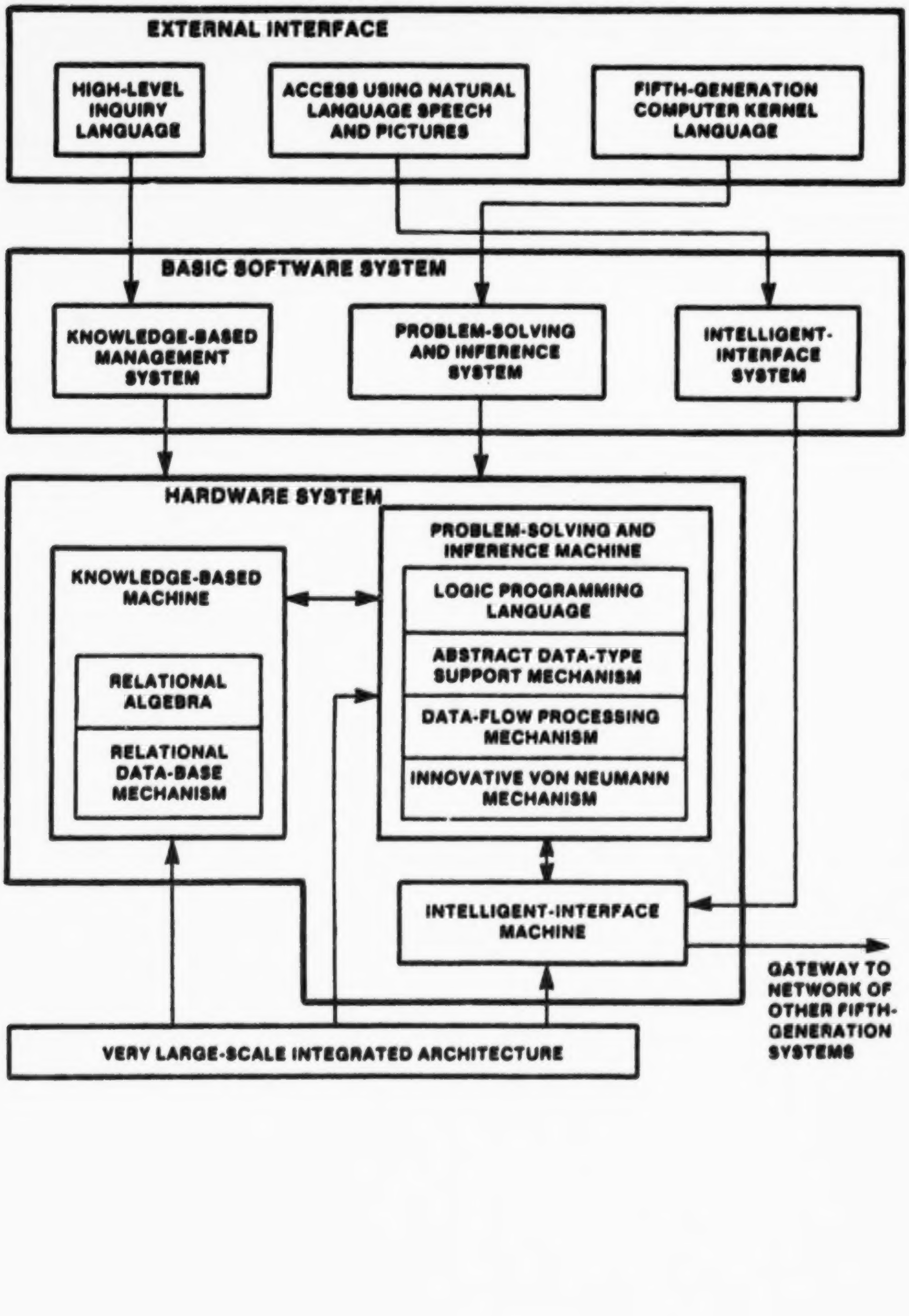
The details of this architecture are not critical. The diagram is shown only to indicate: (1) new and different forms of user languages will be employed; (2) access to computers will be possible using natural language and possibly speech and images or pictures, (3) the software systems will be differently organized; and (4) a whole series of new types of processing will be possible. Future FAA automation efforts may very well be vastly improved by these types of capabilities. However, the impacts on immediate planning are quite limited and arise mostly in connection with the software architecture discussed below. The diagram does illustrate that computer technology is still in a dynamic stage, and that the current replacement program will be unlikely to lead to an equipment configuration that will not be obsolete well before the end of the century.

2. Software Developments

Software development is being driven by three major forces. First, as the cost of computers decreases and the cost of software increases, equipment manufacturers increasingly are charging for software that previously was provided as part of an equipment package. They also are designing their systems with a larger set of associated programs. These decrease the user's need to develop his own software, while increasing the manufacturer's software product line. Second, the rapid growth in costs for users to create software is leading to a wide variety of actions (such as standard packages for lease or sale; new more user- or special-function-oriented languages; tools to support programming efforts; etc.) to counteract this cost trend. Finally, the entire process is taking place with recognition of huge existing investments made by users that cannot be easily or quickly replaced.

FIGURE 2

POSSIBLE 5TH GENERATION ARCHITECTURE


EXTERNAL INTERFACE
HIGH-LEVEL INQUIRY LANGUAGE
ACCESS USING NATURAL LANGUAGE SPEECH AND PICTURES
FIFTH-GENERATION COMPUTER KERNEL LANGUAGE
BASIC SOFTWARE SYSTEM
KNOWLEDGE-BASED MANAGEMENT SYSTEM
PROBLEM-SOLVING AND INFERENCE SYSTEM
INTELLIGENT-INTERFACE SYSTEM
HARDWARE SYSTEM
KNOWLEDGE-BASED MACHINE
RELATIONAL ALGEBRA
RELATIONAL DATA-BASE MECHANISM
PROBLEM-SOLVING AND INFERENCE MACHINE
LOGIC PROGRAMMING LANGUAGE
ABSTRACT DATA-TYPE SUPPORT MECHANISM
DATA-FLOW PROCESSING MECHANISM
INNOVATIVE VON NEUMANN MECHANISM
INTELLIGENT-INTERFACE MACHINE
GATEWAY TO NETWORK OF OTHER FIFTH-GENERATION SYSTEMS
VERY LARGE-SCALE INTEGRATED ARCHITECTURE

The whole area of software development is one of intense activity. For example, it provides the subject for some of the early applications of what are called "expert" artificial intelligence techniques. Some organizations are experimenting with these techniques in order to improve the quality of vendor-supplied software and in a search for improved user-oriented languages.

While many changes must be anticipated, we believe most of them will appear as overlays or as compatible additions to existing software technology. This arises because of the large current user investments already mentioned. It means, for example, that although new languages (such as PASCAL, ADA and APL) are growing rapidly in acceptance, they are unlikely to replace older ones (such as COBOL, BASIC AND PL I). It is for this reason that I commented earlier that language selection is no longer as critical as it once was. If an already well accepted language is employed, there is no reason to expect that it will become obsolete in the next few decades.

What has become more important is the subject of software architecture. The general process of seeking to build growth potential into software is at the heart of current accepted architecture design practices. The critical feature here is to assure that the software design is both modular and data independent. In other words, software must be built in the form of modules, each of which can be structured quite independently internally as long as its interfaces with all other modules are carefully specified and understood. In addition, the design for each module must be structured so that it can accommodate different types of data, with different formats and characteristics, rather than having the data format determine, by itself, the software organization. Using this approach should make it possible to move with relative ease from one system architecture to another. Since it is in the interests of the hardware manufacturers to make this possible, their hardware and system designs will tend to take this into account.

APPLICATIONS TO FAA AIR TRAFFIC CONTROL PLAN

Developments in computer hardware and software are generally favorable to the requirements of the FAA. Distributed systems have a considerable degree of inherent modularity, which is one of the better ways to deal with future growth. They also provide the redundancy necessary to achieve safety and continuity of operations. The potential to employ speciaized processors in bus-oriented systems can assist in dealing with some aspects of the growing complexity of air traffic control, since processors specializing in, for example, automation assistance functions, may very well prove feasible in the future. The criticality of the decision on language selection has declined, while the modular software design that has grown in importance represents a good and relatively natural practice on its own. Major uncertainties exist and will continue to do so, but they exist in a context more favorable than would have been the case a few years ago.

The current FAA plan for replacement of the computer and display complex, as specified in the National Airspace System Plan, involves a two-step process. First, the existing software will be rehosted in a new set of computers by the year 1985. This step is intended to provide the extra computer capacity needed to deal with growth in operations and installations of a variety of automation aids. It will, however, leave the system in a largely centralized processing mode, as at present. The second step, to be completed in the early 1990s, involves development of a new display system and a complete rewriting of the system software. At this stage it is anticipated that considerable processing will be removed from the central hosts and associated with the operations of the display suites.

The current plan was based on one of a number of options that were studied and reported to Congress in January 1982 in the FAA's "Response to Congressional Recommendations Regarding the FAA's En Route Air Traffic Control Computer System." It also was examined briefly, in late 1980, as one of four general alternatives covered during our assignment to assist the FAA in early planning for the program. The obvious question at this point concerns the extent to which the proposed program takes full advantage of progress in computer technology to achieve safety, flexibility and an overall favorable cost-benefit ratio for future air traffic control.

Although I do not know all the reasoning that entered the decision, clearly the plan aims at being a conservative one. While rehosting of software can be a very tricky process, once it is done it will assure adequate capacity to provide time for the development of new software. Software development is the most difficult part of the overall plan and is subject to the greatest uncertainties with regard to completion on schedule. As noted previously, inordinate time pressures tend to force shortcuts that in the long term can be very costly. A successful rehosting approach will provide a time cushion to safely cover these uncertainties.

The two-step program focuses on the display system later than would be necessary with a single-step replacement approach; and, therefore, the display system suites should employ slightly more modern technology when installed. Although two system transitions are necessary with a two-step program, both of them are considerably smaller than that encountered with a single-step replacement; as a result, it probably is safer from the point of view of the users. Although cost and cost-benefit analyses of various options were made in the previously cited report, I do not believe differences among the figures are significant, relative to the extent to which these figures are dependent on the quality with which the program is managed. On the whole, I believe there is a lower probability that critical time pressures would be encountered during the complete replacement program if the two-step process were followed than if there were only one large step. I believe this will provide an environment permitting more effective management and, therefore, better cost control. Even though the new host computers might have to be replaced well before the end of the century, the total program costs would likely, _in practice_, be lower.

I have no basis for stating that the proposed plan either is or is not the optimum one. I can state, however, that it is an entirely reasonable program that can incorporate sufficient choice and flexibility to assure that no major technological possibilities need be eliminated when establishing its structure. As I pointed out earlier, it is a conservative plan which--as a heavy user of the airways--I very much appreciate. In the last analysis, I strongly believe that the quality and the cost-effectiveness of the replacement system will depend more on the quality of its program management than on any other single factor.

Mr. GLICKMAN. Thank you, Mr. Ernst, for your excellent testimony, and for your testimony for the record which goes into much greater detail.

The Office of Technology Assessment has recommended a need for flexibility in the computer system design so that it can accommodate actual traffic growth rather than meet a specific target as forecasted today.

Do you think the technology envisioned by the FAA possesses such flexibility?

Mr. ERNST. I believe it can. The concept of rehosting and then moving functions off into display suite computers has enough modularity that it can be adjusted over time to match traffic demand. Whether and how this flexibility is used is a management decision.

However, I would like emphatically to say that, in decisions as to what constitutes overcapacity or undercapacity, one should look at the costs of the upside and the downside risks. My livelihood over the last 20 years has depended a great deal on the availability of good airline services. I know the work problems that are created when you get a restriction on the availability of air traffic control, such as arose early during the PATCO strike. I think you should take a very careful look at the social costs—the costs to business and personal travelers—of suddenly finding that you don't have enough capacity, and match these costs against the costs of installing what may turn out to be more equipment than you need at a given time. With shrinking equipment costs, I think the answer is likely to favor assurance of adequate capacity. Our forecasting ability will always be limited and I would prefer to see the FAA operate consistently with some overcapacity and with means to add more capacity in time to meet any reasonable growth in demand.

Mr. GLICKMAN. The Office of Technology Assessment, one of their proposed suggestions is upgrading the 9020A's to 9020D's in order to gain near-term capacity, and then designing a fully distributed system based upon the then available technology in the 1990's. What do you think of this idea?

Mr. ERNST. Except as an emergency fallback, I am very uncomfortable with the upgrading concept. In the first place, I think it is going to be more difficult than it sounds. There is no question about it being feasible since it already has been done. But it probably was easier to do 5 years ago than it would be today. You have to start off with IBM 360/65's; these are available but they are not now being built. All 360/65's are not the same—engineering changes were introduced throughout the life of the equipment. So you may have to modify existing 360/65's to bring them up to a specific engineering standard.

If I recall correctly, the FAA configuration, has a rather unusual balance of processing and memory capabilities, so you may have to acquire more 360/65's than you plan to install and cannibalize some of them to get the right balance. When you get through with doing this you have to make modifications that haven't been made for quite a while. I don't know what is involved, but if there are equipment components, they probably will have to be specially built. When you are all through, you will have the needed compute capacity, and the needed memory. However, a limiting factor on the operating capacity of the 9020D's—and this again is based on memory and may not be entirely correct—is what is called "port capacity" which governs ability to communicate with the outside world. Because of this, the eventual performance might turn out to be disappointing.

I also suggest a very hard look at the economics. In the commercial world, we find plenty of organizations that replace old equipment, even though they need no more capacity, because their savings in maintenance and utility costs will more than cover the costs of the new equipment, over a life of 5 or 6 years. In other words, new equipment is so much easier to maintain and so much less demanding of electricity that it can be a good financial investment even when there is absolutely no need for increased capacity.

Mr. GLICKMAN. Implicit in your testimony are management decisions. Do you have an opinion on the management approach that is being adopted by the FAA now, and do you think they have the capability to pursue this approach?

Mr. ERNST. The management approach has been evolving. At the time we started our work, I don't think there was adequate appreciation of the capabilities that would have to be established in a program office. It is my impression—and again, I am somewhat out of touch—that this has changed. I think that there is plenty of talent available within the FAA, given reasonable contractor support, to do the job. They will need adequate budgets and authority to do limited hiring; but, given this, they should be able to do a first-class job.

Mr. GLICKMAN. OK. Mr. Dunn.

Mr. DUNN. Thank you, Mr. Chairman.

Much of your work, Mr. Ernst, in recent years has been on the social impact of new technology, and you touched on that as to whether or not the system would be significantly flexible to meet the demands of society. I think you said that, in your opinion, it was.

Could you talk a little bit about the social impact on the projections for the FAA and their own hiring? Are they projecting the right numbers of people in this report that go along with this new technology, in your opinion?

Mr. ERNST. I really have not looked at those figures in detail. I note that there are references to reductions in maintenance staff and utilities costs, and I believe these trends are quite appropriate because fairly dramatic decreases have been demonstrated within other organizations. I think we can look forward to steady increases in automation aid for and productivity of controllers. But I am not prepared to comment on the detailed figure.

Mr. **Dunn**. Thank you.

Mr. **Glickman**. Thank you very much for your excellent testimony.

Our last witnesses are a panel. From the Office of Technology Assessment we have Dr. John McLucas, Chairman of the OTA Conference on the NAS plan, and former Administrator of the Federal Aviation Administration; and Dr. John Andelin, Assistant Director of Science, Information and Natural Resources Division, Office of Technology Assessment.

Gentlemen, we appreciate your being here. Apparently you have separate testimony, so, Dr. McLucas we would like for you to go first, and then Dr. Andelin. Your entire statements will appear in the record, so you may feel free to summarize if you deem that appropriate.

STATEMENTS OF JOHN McLUCAS, CHAIRMAN, OTA CONFERENCE ON NAS PLAN, OFFICE OF TECHNOLOGY ASSESSMENT; AND DR. JOHN ANDELIN, ASSISTANT DIRECTOR, SCIENCE, INFORMATION AND NATURAL RESOURCES DIVISION, OFFICE OF TECHNOLOGY ASSESSMENT

Mr. **McLucas**. Thank you, Mr. Chairman. I am very happy to be here to testify on a topic which has been near and dear to me for a long time. At the same time, because I am 5 years separated from my active duty with the FAA, I leave it to you to decide the extent to which my views may be somewhat less up to date than they otherwise might be. But I will be speaking mainly as someone who did work in the FAA system for a number of years, and who has tried to follow it since.

At the invitation of OTA, I served as chairman of the 2-day conference on the NAS plan, held on April 1 and 2 of this year. We had some 25 invited participants—representatives of aviation organizations, experts in computer and communication technology, academicians, and others—as well as observers from FAA, DOT, and congressional committees. A list of the participants is appended to my written testimony.

The agenda on the conference—which is also appended to my written testimony—directed attention to four principal topics: growth of aviation; implementation of the FAA plan; effects on airspace users; cost and funding issues.

My understanding of the objective of the conference, as reflected in my opening statement to the participants at that conference, was that we were to try to reach a balanced and fair appraisal of the NAS plan—both in the overall sense, and in the principal particulars. Our aim was not to reach a consensus or a compromise that everyone could agree on, but to bring out the views of the various participants. If we found that we could reach agreement, so much the better, but we were concerned that divergence of opinion and controversy would also be brought out.

The NAS plan rests on the assumption of continued, and rather high, growth in civil aviation—particularly in general aviation. The FAA traffic and workload forecasts drive the plan both with respect to the long-term capacity that must be attained and with respect to the timing of the near-term improvements, such as replacement of the en route computer system.

Conference participants had rather mixed views about the credibility and accuracy of the FAA forecasts of traffic. Some felt that the forecasts were unduly optimistic about the recovery of the air carriers from the present slump and about the rebound of sales of general aviation aircraft which, as everyone knows, are down. Therefore, they doubted that the traffic forecasts for the mid and late 1980's would materialize.

Other conference participants took the view that aviation growth would resume once the economy took an upward turn and that the FAA projections were probably reasonable as planning targets, if not as forecasts of actual aviation activity. In their view, it was probably the better strategy to err on the high side for planning purposes and to have excess capacity, rather than to err on the low side and run the risk of constraining civil aviation through the lack of ATC facilities to meet the demand for service, or worse yet, compromise safety. On the whole, it was agreed that implementation of the plan should be flexible and adapt to growth in demand as it actually occurs while still stressing the need for overall capacity targets and spending levels.

There was a widely shared view at the conference that traffic forecasts were not the principal consideration in assessing the reasonableness of the NAS plan or the need for specific improvements. Many felt that, even if growth were much slower than the FAA forecasts, it would still be necessary to proceed with the plan for reasons of safety and because it is becoming harder and harder to maintain obsolete equipment and in order to reduce operating and maintenance costs through automation and consolidation of ATC facilities.

In other words, many participants felt that a cornerstone of the plan is, and should be, the immediate initiation of a program to replace the outmoded air traffic control system with modern hardware and software of greater capacity, reliability and flexibility.

Most of those at the conference felt that the risks inherent in the plan proposed by FAA are more management related than they are technology related. The greatest risk and the greatest challenge lie in making the transition from the present system to the new system of the 1990's. If the life of the present computers is extended too long, maintenance will become more difficult and the capacity to introduce new functions will be limited.

If present software is "rehosted"—to use an FAA term—to new computers which are to be used for the next two decades, the choice of computers selected now to solve near-term problems may limit future system development. Rehosting to interim computers—or using what they call emulation—to provide adequate capacity during the new software development phase seemed a reasonable course to avoid freezing the computer technology or the system architecture now, even if the interim computers themselves had to be replaced later.

The best way to proceed is really a judgment call, and our conference did not have time to develop this in detail. The FAA plan is to proceed with solicitation of bids from contractors on computer replacement. The conference suggested that a final determination of the replacement strategy be postponed until proposals have been received and evaluated.

The ability of the FAA to implement and manage an undertaking of this magnitude was discussed. FAA has the ultimate responsibility for the safety of those using the national airspace system and cannot subcontract that responsibility. Thus, we agree that FAA should manage the program itself and not rely on contractors for "turnkey" systems.

However, because of limited talent and little past success in systems procurement, FAA should take prompt steps to obtain the necessary management and systems engineering assistance, both from outside sources in the industry and by strengthening its own internal capability. FAA could begin now by taking on a major system engineering contractor since there remain a number of key systems architecture and phasing decisions to be made.

I would now like to touch briefly on several specific points which concerned us at the OTA Conference.

The first is safety. The NAS plan does not specify the most urgent safety needs, nor does it show the relationship between specific programs and safety objectives. If full funding of the plan turns out not to be possible, for whatever reason, each year's budget must be examined closely to prevent safety-related items from being dropped or deemphasized. In setting safety priorities, careful consideration should be given to the relationship and interdependency of program elements. Failure to do so could adversely affect safety or disrupt the balance between safety and other objectives such as efficient use of airspace, increase of system capacity, or reduction of operating cost. In short, a thorough systems look is necessary.

Just a word or two about the man-machine interface. The new sector suites and the AERA concept push reliance on automation much further than current practice. Thus, it is contemplated that individual controllers in the future system will be able to handle more aircraft, and their duties and responsibilities would be changed significantly from what they have been historically. Care will be needed in designing man-machine interfaces to achieve the desired increases in controller productivity while, at the same time, assuring that the human operator retains effective control of system operation and can intervene promptly and appropriately when human override of automated functions becomes necessary. It was our impression that more work on the man-machine interface now could avoid costly disappointments later if major assumptions about human productivity improvements do not materialize.

A word about airports. The NAS plan acknowledges that airport capacity will be a major, if not the major, constraint on the future growth of aviation. Yet, the plan does not address measures to increase airport capacity or to make efficient use of existing capacity. A companion airport development program is definitely needed.

In developing this program, FAA should give careful attention to the relationship between airport needs and the new facilities and equipment proposed for modernization of airways and air traffic control. As a specific example, increased attention should be given to technology to reduce the wake vortex problem at its source or to aid in detection and prediction of serious wake vortex conditions. I know this is a difficult problem because we worked on it when I was at FAA, but the problem remains and still deserves major attention. Solution of the wake vortex problem—through some combination of new aircraft technology, improved predictive techniques, and enhanced air traffic control procedures—may be the single most important way to increase runway acceptance rates and ease capacity limitations at major airports.

Now a word about funding. Unless adequate long-range funding is assured, there is little prospect that the air traffic control system modernization proposed by FAA will be accomplished. It is vital, therefore, that airspace users and the Government reach agreement on what constitutes a fair and equitable method whereby user charges are to be levied. There was particular concern expressed at the OTA Conference about the current administration proposal to cover 85 percent of FAA operation and maintenance costs from user revenues, but it was recognized that this issue would have to be resolved in the appropriate congressional committees. Incidentally, my own view is that it is less important to find the ideal cost allocation formula than it is to adopt something which is not too far from past practices and which would generate about the right amount of revenue.

Finally, despite inevitable flaws in some details of the plan, the OTA Conference tended to the view that the plan merits general endorsement and support. We do not want to make it appear by our criticisms that we are against the FAA's plan. The plan is a comprehensive attempt to resolve present problems and to build toward meeting long-term needs. It was also generally believed that FAA, the Congress, and the aviation community should seek to reach agreement on the general framework within which system modernization should proceed, while reserving judgment about specific programs until more information is available or until requirements have been more clearly defined.

To add my personal view, I believe it is important and necessary at this juncture to seek a commitment on the general direction to be taken and the overall strategy to be followed in modernizing the national airspace system. I think it is essential that we agree now on where we are going and how we plan to get there—in general terms. It will be important to build the justification for the specifics of the plan step by step as the work goes on.

Thus, I believe it would be a mistake for FAA to place too much emphasis on securing a full and firm commitment to all parts of the plan at the beginning. Instead, I believe we should commit ourselves to a process of continuing examination, discussion and refinement of individual programs which will serve objectives that we can collectively support.

Thank you, Mr. Chairman.

Mr. **Glickman**. Thank you, Dr. McLucas, for an excellent statement.

[The prepared statement of Mr. McLucas follows:]

STATEMENT
OF DR. JOHN L. McLUCAS
BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
APRIL 29, 1982

Mr. Chairman and Members of the Committee:

I appreciate this opportunity to appear before the Committee today to comment on the National Airspace System Plan issued by the Federal Aviation Administration in January 1982. My remarks today will deal primarily with my observations as Chairman of the OTA Conference on the National Airspace System Plan, but I would also like to speak from my perspective as former FAA Administrator and former Secretary of the Air Force.

At the invitation of the Office of Technology Assessment, I served as Chairman of a two-day conference on the NAS Plan, held on April 1-2 of this year. There were some 25 invited participants--representatives of aviation organizations, experts in computer and communication technology, academiciams, and others--as well as observers from FAA, DOT, and Congressional committees. A list of the participants is appended to my written testimony.

The agenda of the Conference (which is also appended to my written testimony) directed attention to four major topics:

- o Growth of Aviation
- o Implementation of the FAA Plan
- o Effects on Airspace Users
- o Cost and Funding Issues

My understanding of the objective of the Conference, as reflected in my opening statement to the participants, was that we were to try to reach a balanced and fair appraisal of the NAS Plan--both overall and in the more important particulars. Our aim was not to reach a consensus or a compromise "conference position," but to bring out the views of the various participants. If we found agreement, so much the better. But we were concerned that divergence of opinion and controversy also were brought out.

General Conference Views

The NAS Plan rests on the assumption of continued, and rather high, growth in civil aviation--particularly in general aviation. The FAA traffic and workload forecasts drive the Plan both with respect to the long-term capacity that must be attained and with respect to the timing of near-term improvements, such as replacement of the en route computer system.

Conference participants had rather mixed views about the credibility and accuracy of the FAA forecasts. Some felt that the forecasts were unduly optimistic about the recovery of air carriers from the present slump and about the rebound of sales of general aviation aircraft. Therefore, they doubted that the traffic forecasts for the mid- and late-1980's would materialize. Other Conference participants took the view that aviation growth would resume once the economy took an upward turn and that the FAA projections were probably reasonable as planning targets, if not as forecasts of actual aviation activity. In their view, it was probably the better strategy to err on the high side for planning purposes and to have excess capacity, rather than to err on the low side and run the risk of constraining civil aviation through the lack of ATC facilities to meet the demand for services or worse yet, compromise safety. On the whole, it was agreed that implementation of the plan should be flexible and adapted to growth in demand as it actually occurs while still stressing the need for overall capacity targets and spending levels.

There was a widely shared view at the Conference that traffic forecasts were not the foremost consideration in assessing the reasonableness of the NAS

Plan or the need for specific improvements. Many felt that, even if growth were much slower than the FAA forecasts, it would still be necessary to proceed with the plan for reasons of safety and because it was becoming harder and harder to maintain obsolete equipment and in order to reduce operating and maintenance costs through automation and consolidation of ATC facilities. In other words, many particpants felt that a cornerstone of the plan is, and should be, the immediate initiation of a program to replace the outmoded ATC system with modern hardware and software of greater capacity, reliability, and flexibility.

Most of those at the OTA Conference felt that the risks inherent in the plan proposed by FAA are more management-related than technology-related. The greatest risk and the greatest challenge lie in making the transition from the present system to the new system of the 1990's. If the life of the present computers is prolonged unduly, maintenance will become more difficult and the capacity to introduce new functions will be limited. If present software is "rehosted" to new computers which are to be used for the next two decades, the choice of computers selected now to solve near-term problems may limit future system development. Rehosting to interim computers (emulators) to provide adequate capacity during the new software development phase seemed a reasonable course to avoid freezing the computer technology or the system architecture now, even if later the interim computers themselves were replaced.

The best way to proceed is a judgment call that the Conference did not have time to resolve. The FAA plan is to proceed with solicitation of bids from contractors on computer replacement. The Conference suggested that a final determination of the replacement strategy be postponed until proposals have been received and evaluated.

The ability of FAA to implement and manage an undertaking of this magnitude was discussed. FAA has the ultimate responsibility for the safety of those using the national airspace system and cannot subcontract that responsibility. Thus, we agreed that FAA should manage the program itself and not rely on contractors to provide "turnkey" systems. However, because of limited talent and little successful history in systems procurement, FAA should take prompt steps to obtain the necessary management and system engineering assistance, both from an outside source in the industry and by strengthening its own internal capability. FAA could begin now by taking on a major system engineering contractor since there remain a number of key systems architecture and phasing decisions to be made.

Specific Concerns

I would now like to touch briefly on several specific points of concern expressed at the OTA Conference.

Safety

The NAS Plan does not specify the most urgent safety needs, nor does it show the relationship between specific programs and safety objectives. If full funding of the plan turns out not to be possible, each year's budget must be examined closely to prevent safety-related items being dropped or deemphasized. In setting safety priorities, careful consideration should be given to the relationship and interdependency of program elements. Failure to do so could adversely affect safety or disrupt the balance between safety and other objectives such as efficient use of airspace, increase of system capacity, or reduction of operating cost. In short, a thorough systems look is necessary.

Man-Machine Interface

The new sector suites and the AERA concept push reliance on automation much further than current practice. Thus, it is contemplated that individual controllers in the future system will be able to handle more aircraft, and their duties and responsibilities would be changed significantly. Care will be needed in designing man-machine interfaces to achieve the desired increases in controller productivity while--at the same time--assuring that the human operator retains effective control of system operation and can intervene promptly and appropriately when human override of automated functions is necessary. It was our impression that more work on the man-machine interface now could avoid costly disappointments later if major assumptions of human productivity improvements do not materialize.

Airports

The NAS Plan acknowledges that airport capacity will be a major, if not the major, constraint on the future growth of aviation. Yet, the plan does not address measures to increase airport capacity or to make more efficient use of existing capacity. A companion airport developmnt program is required. In developing this program, FAA should give careful attention to the relationship between airport needs and the new facilities and equipment proposed for modernization of airways and air traffic control. As a specific example, increased attention should be given to technologies that will reduce the wake vortex problem at its source or that will aid in detection and prediction of serious wake vortex conditions. Solution of the wake vortex problem--through some combination of new aircraft technology, improved predictive techniques, and enhanced ATC procedures--may be the single most important way to increase runway acceptance rates and ease capacity limitations at major airports.

Funding

Unless adequate long-range funding is assured, there is little prospect that the ATC system modernization proposed by FAA will be accomplished. It is vital, therefore, that airspace users and the Government reach agreement on what constitutes a fair and equitable method whereby user charges are to be levied. There was particular concern expressed at the OTA Conference about the current Administration proposal to cover 85 percent of FAA operation and maintenance costs from user revenues, but it was recognized that this issue would have to be resolved in the appropriate congressional committees. Incidentally, my own view is that it is less important to find the ideal cost allocation formula than it is to adopt something which is not too far from past practice and which will generate about the right amount of revenue.

Final Remarks

Despite inevitable flaws in some details of the plan, the OTA Conference tended to the view that the plan merits general endorsement and support. The plan is a comprehensive attempt to resolve present problems and to build toward meeting long-term needs. It was also generally believed that FAA, the Congress, and the aviation community should seek to reach agreement on the general framework within which system modernization should proceed, although reserving judgment about specific programs until more information is available or until requirements have been more clearly defined.

To add my personal view, I believe it is important and necessary at this juncture to seek a commitment on the general direction to be taken and the overall strategy to be followed in modernizing the national airspace system. I think it is essential that we agree now on where we are headed and how we plan to get there--in general terms. It will be important to build the justification for the specifics of the plan step by step as the work progresses. Thus, I believe it would be a mistake for FAA to place too much emphasis on securing a full and firm commitment to all parts of the plan at the outset. Instead, I believe we should commit ourselves to a process of continuing examination, discussion, and refinement of individual programs which will serve objectives that we collectively support.

OTA Conference on
The National Airspace System Plan
April 1-2, 1982

Chairman:
Dr. John L. McLucas
President
Comsat World Systems

Mr. Ward Baker
Airline Pilots Association

Mr. Frederick Bradley, Jr.
Senior Vice President
Citibank, N.A.

Mr. Samuel C. Colwell
Director, Market Planning
Fairchild Industries, Inc.

Mr. Anthony Csicseri
U.S. General Accounting Office

Mr. Elwood T. Driver
Former Vice Chairman
National Transportation Safety Board

Mr. Thomas S. Falatko
Deputy for Transportation
and Civil Aviation
U.S. Air Force

Mr. Matthew Finucane
Director
Aviation Consumer Action Project

Captain Rod Gilstrap
Director
Flight Safety and Industry Affairs
United Air Lines

Mr. William T. Hardaker
Assistant Vice President
Air Transport Association

Mr. William Horn, Jr.
National Business Aircraft Association

Mr. Victor J. Kayne
Senior Vice President
Technical Policy and Plans
Aircraft Owners and Pilots Association

Mr. David Lewis
Congressional Budget Office

Mr. John F. Leyden
Executive Director
Public Employees Department
AFL-CIO

Mr. Kingsley G. Morse
Chairman
Regional Airlines Association

Mr. Gilbert F. Quinby
Consultant

Mr. J. Donald Reilly
Executive Vice President
Airport Operators Council International

Dr. Harrison Rowe
Bell Telephone Laboratories

Dr. Robert C. Seamans, Jr.
Professor of Environment and Public Policy
Massachussetts Institute of Technology

Dr. Robert W. Simpson
Flight Transportation Laboratory
Massachussetts Institute of Technology

Mr. H. Clark Stroupe
Booz-Allen & Hamilton

Mr. Richard W. Taylor
Vice President
Boeing Commercial Airplane Company

Mr. David Thomas
Consultant
General Aircraft Manufacturers Association

Mr. Vincent Volpicelli
Supervising Engineer
Port Authority of New York
and New Jersey

Dr. Willis Ware
Rand Corporation

AGENDA

OTA Conference on
The National Airspace System Plan
April 1-2, 1982

Thursday, April 1

9:00-9:10 **Welcoming Remarks and Introductions**

9:10-12:00 **Growth of Aviation**

Summary of Working Group 1 & 2 - Clark Stroupe

FAA Forecast Methods - David Lewis

Discussion:

- Factors influencing aviation growth
- Responsiveness of FAA plan to growth and need for services

12:00-1:30 **Lunch**

Guest Speaker: J. Lynn Helms
Administrator
Federal Aviation Administration

1:30-4:30 **Implementation of FAA Plan**

Summary of GAO Studies - Tony Csicseri

Discussion:

- Technological risks
- Implementation problems
- Scheduling
- Flexibility and preservation of options

4:30-5:30 **Reception (cash bar)**

Friday, April 2

9:00-12:00 **Effects on Airspace Users**

Summary of Questionnaire Responses - Larry Jenney

Discussion:

- Potential benefits and problems
- Difficulties during transition
- Implications of automation
- Consolidation of facilities

12:00-1:30 **Lunch**

Guest Speaker: Philip J. Klass
Senior Avionics Editor
Aviation Week & Space Technology

1:30-3:30 **Cost and Funding Issues**

Summary of Questionnaire Responses - Larry Jenney

Impact of User Fees - David Lewis

Discussion:

- User fees and other funding strategies
- Operating and maintenance costs
- Allocation of revenues

3:30-4:30 **Summation and Concluding Remarks**

Review of Key Issues

Recommendations for Additional Study

Mr. **Glickman**. I might tell both of you that the House goes in at 11 o'clock today, and there will be a series of votes. So I would like to finish by 11 o'clock, if possible. Your statement is fairly long. If you could summarize so we could have about 15 minutes for questions, we would appreciate it.

Mr. **Andelin**. I will.

Mr. **Glickman**. Thank you. As you know, the entire statement will appear in the record.

Mr. **Andelin**. Mr. Chairman and members of the committee, I am pleased to work with you and your staff again. We appreciate the opportunity to speak to you about our work on air traffic control.

My testimony concerns a recent review that OTA conducted of the national airspace system plan released by the FAA in January. My statement summarizes the results of that review to date. The final report is in the last stages of internal and external review and will be published soon. So, while I would not suggest that any changes are likely to be made, the report is still open for external criticism.

Mr. **Glickman**. This is what you are talking about, a document, "Review of the FAA 1982 National Airspace System Plan," April 1982?

Mr. **Andelin**. Yes.

Mr. **Glickman**. And it is marked draft.

Mr. **Andelin**. It has not been publicly released, but it has been released to the committees and to our panels.

Mr. **Glickman**. As far as you know, this is substantially what the document will look like?

Mr. **Andelin**. As far as I know.

Mr. **Glickman**. OK.

Mr. **Andelin**. We have no reason at the moment to make substantial changes.

Mr. **Glickman**. OK.

Mr. **Andelin**. Two comments about that particular review and about OTA's work in general. The first is that we do not make recommendations, as such. In most cases, we state findings, and, depending upon ones set of values, they can often be interpreted as conclusions by individuals. But different people draw different recommendations from our work.

The second point is that we often find ourselves quoted and paraphrased. If it really matters, I would suggest that one be careful, as we try to be, to look at what we said, not at what people say we said. Paraphrases can be pretty dangerous with highly technical work. We have trouble enough ourselves saying it so that we agree. Once it is paraphrased, there occasionally are some shifts of emphasis that we find inappropriate.

My testimony today draws on two major sources. First is an assessment that was completed in January and delivered very recently to the House Committee on Appropriations. I believe you have copies of our January report.

Second, we held a series of working groups and conferences. Dr. McLucas just gave you an excellent presentation, I think, of the discussion at the conference itself.

I will not say much about the document that you have in front of you—the publicly released report—except to state a few of the major conclusions.

The first is that the congestion and delay in the system is primarily at hub airports. The future growth is going to spread that congestion to a number of additional airports.

Second, we believe that there will be continued growth in air traffic, but it will be slower than the growth in the past 20 years and probably slower than the FAA forecasts. The constraint that we see on the future growth of aviation, the major one, is airport and terminal area capacity.

Finally, in the January report, we observe that there are three ways to affect airport and airspace capacity: Technological means represented by improvements in the ATC systems, economic measures, and regulatory actions. The technological ones include the entire ATC system and the wake vortex detection, prediction and reduction mentioned by Dr. McLucas.

The major capacity increases to be realized by these technological changes will, in fact, not take place for some years. They will require automated metering and spacing, microwave landing systems, and something, perhaps, if we are fortunate, with regard to wake vortex.

In the meantime, and perhaps for the foreseeable future, congested airports will have to make use of demand-management alternatives—including economic measures, slot allocations, and so on—in order to shift traffic to a time or place where it can be handled. We expect that all approaches, regulatory, technical and economic, will be used.

That is the background in our January report.

With those findings in mind, I would now like to discuss our review of the national airspace system plan. Viewed as a statement of policies, goals, and directions, the plan is to be commended as a significant and, we believe, even bold step, compared to past FAA efforts to chart the future evolution of the system. But it is not without faults.

First, it is only one of a series of documents and plans, some of which have not yet been published. It is difficult to judge the plan without knowing its relationship to the context of overall FAA plans. Second, the implementation schedule and some of the options that are chosen seem to be premised on reasonably specific demand forecasts, a bit more knowledge of the future than we would claim to have. Finally—as Dr. McLucas pointed out—it lacks contingency plans. What if it cannot be done fully? What if there are delays somewhere? What are the priorities?

To go back over those three points quickly: We see the national airspace system made up of three major ports—the air traffic control system, airports, and procedures for using the airspace. The NAS plan, unfortunately, deals only with the air traffic control system. We are still waiting for FAA to issue plans for the other two parts. FAA is working on them, but the national airspace review—which has just begun—is a 42-month study, so the final results will not be available until the mid-1980's.

By first issuing a plan for modernizing ATC technology without waiting until other efforts have at least defined the needs in the area of airports and airspace procedures, FAA creates the impression that we should or even could rely on technological solutions. This perception is reinforced by the NAS plan itself, which gives first priority to improved technology for the en route system by the late 1980's. However, it is lack of airport capacity, not air traffic control technology, which will be the principal limit on the growth of aviation. We see little apparent advantage in seeking to move enroute traffic more expeditiously, only to have it encounter delays in terminal areas where capacity improvements are not scheduled to be made until the early 1990's.

With regard to traffic demand, our concern is not technical feasibility; FAA's proposals are technically feasible and consistent with goals of safety, productivity, and accommodating future growth. Rather our concern is that FAA's proposals seem to be designed to accommodate a rather specific future growth. On that point, they are less flexible than we might otherwise wish. Options that could be as effective, less costly, and possibly superior in the long run appear to have been rejected because they could not be implemented in time to meet the FAA projected demands. Because FAA is committed to meeting a specific and high level of demand, the choice of options is somewhat limited. If one adopts a more flexible approach that can accommodate higher or lower levels of growth, there are different options that might be explored, at least initially.

Even if one assumes the options chosen are appropriate, we have another concern—the plan does not have a clear statement of priorities and contingencies. It states the goals and the rationale, but does not show how budgetary constraints or any snags or interruptions in the development of technology and the procurement process would be taken into account. The plan is premised on meeting a specific demand at a specific time; but if delays occur, that need may not be met. Contingency plans may well be discussed in other FAA documentation, but not in the NAS Plan and related reports available to us.

We hope that FAA will carry their explanation a step further and describe the logical dependencies among the different elements of the plan, the critical paths of development, and specific relationships to the goals of safety, capacity and productivity.

There are four general issues that I would like to mention quickly. Then, as you suggest, Mr. Chairman, I will respond to questions. These issues are projected levels of demand, specific technologies, the effect of the improvements proposed on airspace users, and the cost of funding the improvements.

With regard to demand, we know that historically FAA long-range planning has estimated considerably higher demand than actually occurred. That does not say that FAA is doing so now; it says they have done it in the past. To the extent that FAA forecasts may overestimate future traffic levels, they may also overestimate the user fee revenues that they are planning on to pay for the proposed improvements. So, if there are errors in demand forecasts, there will be shortfalls in the revenue collected.

With regard to specific technologies, we believe there is wide agreement, including OTA, that the present ATC system should be upgraded, replaced, improved, and modernized. At the same time, there is wide disagreement about what steps should be taken and how rapidly the specific steps need to be implemented.

With regard to system design and transition—and let me use en route computer replacement as an example—FAA has chosen to move from the present system to the new system in overlapping steps. Namely, they intend first to replace the present computers—that is the rehosting concept. Then FAA plans to install new sector suites, the controllers' display units and at the same time replace the software. Finally, FAA will add new automated functions. The advantage of this is that there is a certain amount of safety in each step, you are not changing things very much at each point. The disadvantage is that you can only go so far from where you started if you do overlapping steps. It is not unlike when the pants to a suit wear out and you buy new pants, and then the jacket wears out and you buy a new jacket. There are constraints built into the final system because you have proceeded in an iterative manner. The technical risks are decreased at each step along the way, but the risks to the final design increase.

This rehosting approach was criticized by many of the participants at the OTA conference, as we point out in our written testimony. We would be pleased to answer questions about the problems of rehosting and why we have discussed—and I do not say recommended, but discussed—upgrading the 9020A's to 9020D's as an alternative approach.

With regard to automation and human factors, we concur that automation will improve productivity, not only for FAA, but also for the airspace users. We suggest that FAA be very careful to insure that increased automation does not put controllers in a situation where it is more difficult for them to assert control or to take over in case of system failure.

With regard to satellite technologies, we are surprised that FAA does not foresee a role for satellites before the end of the century. The technology has developed very rapidly over the past few years. Satellites have considerable potential for communication and for surveillance and navigation. FAA does envision that satellites could eventually have a role, but FAA believes they are not yet a cost-effective alternative to ground-based systems. To some extent, this is one of the technologies not being considered because of the assumed growth in demand. FAA has stated that satellites cannot be implemented in time to meet anticipated needs.

With regard to the impacts on airspace users, the proposed improvements are directed primarily to the needs of IFR traffic. They also benefit FAA itself by automating functions and reducing labor costs. The principal user benefits will be for air carriers and larger business aircraft. Some general aviation users have expressed reservations about the FAA plans.

The Department of Defense has concerns that they have expressed at our conferences. DOD is a major user and joint administrator of the national airspace. Yet, the 1982 NAS plan appears to have been developed without consultation with DOD. DOD representatives have expressed concerns about cost and, in some cases, compatibility, of the avionics that will be required for systems such as mode S and TCAS.

Mr. GLICKMAN. Why don't we stop you now, if possible.

Mr. **Andelin**. Sure.

Mr. **Glickman**. I want to make sure that there is some time here for questions.

Mr. **Andelin**. The only point left to make is with regard to cost and funding, where we say that the proposed system of user fees falls unevenly on different classes of users.

That is the end of my oral testimony.

[The prepared statement of Mr. Andelin follows:]

TEXT OF REMARKS BY JOHN ANDELIN, ASSISTANT DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

APRIL 29, 1982

Mr. Chairman and Members of the Committee: Thank you for inviting the Office of Technology Assessment to appear before you today. I am here to report to you on the results to date of a review that OTA conducted of the National Airspace System Plan released by the Federal Aviation Administraton last January. This review was undertaken by OTA at the request of the House Committee on Appropriations, Subcommittee on Transportation. My statement today summarizes the results of this review, which we will complete over the next month. A draft version of our report has been made available to this Committee.

In conducting the review of the FAA National Airspace System Plan, OTA drew on two major sources:

o First, our assessment of the airport and air traffic control system, which was completed, coincidentally, at about the same time the FAA Plan was issued. The report of this assessment was delivered formally to the House Committee on Appropriations last week. Copies have also been made available to your Committee.

o Second, meetings and workshops with members of the aviation community and various experts in the fields of air traffic control and computer and communication technologies. OTA held three major meetings:

1) A working group on aviation forecasting and aviation growth scenarios;

2) A working group on computer and communication technology;

3) A two-day conference on the National Airpsace System Plan, held April 1 and 2, and attended by 25 aviation and air traffic control technology experts. The Conference was chaired by Dr. John McLucas, President of Comsat World Systems, and formerly Administrator of the FAA and Secretary of the Air Force. Dr. McLucas is with me today and will present his statement later.

* * *

I will direct my statements today primarily to the 1982 National Airspace System Plan and the results of our review of that document. However, I would like first to touch upon the findings of the basic OTA assessment.

In December 1981, OTA completed an assessment of the airport and air traffic control (ATC) system, with emphasis on the problem of congestion at major hubs and on the feasibility, cost, and impacts of proposed ATC technology. This assessment arrived at the following major conclusions:

o Congestion and delay in the system result primarily from the concentration of air traffic at a few major hub airports. The future growth of air traffic will aggravate congestion problems and spread them to additional airports.

o There will be continued growth in air traffic through 2000, but the rate of growth will be slower than in the last 20 years and probably slower than projected in FAA aviation forecasts. The principal constraint on the future growth of aviation will be the lack of sufficient airport and terminal area capacity.

o There are three basic forms of response to airport and airspace capacity problems: technological, economic, and regulatory. Changes in ATC technology and procedures can produce increase in capacity by allowing airspace and runways to be utilized more efficiently. However, much of the capacity increase to be derived from technology will not be realized until advanced systems such as automated metering and spacing; microwave landing system; and wake vortex detection, prediction, or reduction are developed and deployed by the end of this decade or later. In the interim, congested airports will have to make use of demand-management alternatives--including economic measures such as peak-hour pricing and regulatory measures such as slot-allocation quotas or access restrictions--in order to shift traffic to a place or time when it can be handled more effectively.

- All three approaches will be used, and the combination or emphasis will reflect both local conditions and a more fundamental policy decision: can the Nation continue its past practice of accommodating growth wherever and whenever it occurs, regardless of the cost; or is growth to be managed and directed so as to make economical use of existing resources and capacity.

THE 1982 NATIONAL AIRPORT SYSTEM PLAN

With these findings of the OTA assessment as background, I would now like to turn to the National Airspace System Plan released by the Federal Aviation Administration in January 1982. The NAS Plan outlines FAA's most recent proposals for modernizing the facilities and equipment that make up the air traffic control (ATC) system. The plan attempts to integrate the various improvements into a single long-range program that addresses major shortcomings and reduces costs of the current system. Viewed at a high level--as a statement of policies, goals, and directions--the NAS Plan is to be commended as a significant and even bold step compared to past FAA efforts to chart the future evolution of the system. But it is not without faults.

The national airspace system is a "three-legged stool" made up of airports, the ATC system, and procedures for using the airspace. All three need to be improved in an integrated fashion, but the NAS Plan deals with only one leg--the ATC system. OTA's assessment of the airport and ATC system found that lack of airport capacity--not ATC technology--will be the principal limit on the growth of aviation. The NAS Plan itself acknowledges that "capacity limitations at busy airports will be the constraining element" in the system. Nevertheless, the NAS Plan concentrates on ATC technology improvements that are directed at modernizing the en route, not the terminal area, portion of the system.

This is not to say that FAA ignores airports and airspace procedures. A revised plan for airport development is to be issued later this year. FAA has also just begun a National Airspace Review, a 42-month effort that will reexamine the rules and procedures governing the use of the airspace. Still, by first issuing a plan for modernizing ATC technology, without waiting until the other efforts have at least defined needs in the area of airports and airspace procedures, FAA creates the impression that we should, or even could, rely on technological solutions. This perception is reinforced by the NAS Plan itself, which gives first priority to improved technology for the en route system by the late 1980's. There is little apparent advantage in seeking to move en route traffic more expeditiously only to have it encounter delays in terminal areas, where capacity improvements are not scheduled to be made until the early 1990's.

With these reservations, the FAA plan for ATC system improvements is comprehensive. The proposed changes are technologically feasible, and they are consistent with the goals of increasing safety and productivity and accommodating future growth. In fact, providing capacity to accommodate anticipated growth at certain en route centers and terminal areas appears to have been the driving factor in the choice of technologies and in the implementation schedule proposed in the NAS Plan. FAA's long-term traffic and workload forecasts have tended to be too high in the past, however, and in some cases technological alternatives that might be equally effective or less costly than those selected by FAA in the NAS Plan appear to have been rejected because they could not be implemented in time to meet FAA's projected growth in demand for ATC services. If the FAA forecasts are too high, some of these technological options may warrant reexamination.

Even if the options presented in the 1982 NAS Plan are the appropriate ones, the Plan lacks a clear statement of priorities and contingencies. It states the goals of system development and describes the rationale of the planning process, but it does not relate these goals to specific programs in a systematic fashion. If, because of budgetary constraints or failure to meet engineering objectives, some items must be eliminated or schedules must be altered, the Plan does not make clear what effects this would have on the development of the system as a whole. Nor is it made explicit how elements of the Plan could be eliminated or rescheduled in such a way that major objectives are not compromised.

It might be hoped that the FAA will carry the explanation one step further by describing the logical dependencies among elements of the Plan and by indicating critical paths of development and specific relationships to the goals of safety, capacity, and productivity.

OTA's review of the 1982 NAS Plan identified questions about four general issues:

o the projected levels of demand;

o the specific technologies chosen;

- the effects of the proposed improvements on airspace users; and
- the cost and funding of these improvements.

PROJECTED LEVELS OF DEMAND

Accommodating the anticipated growth of air traffic and ATC workloads is a primary justification for the system improvements proposed by FAA. In the past, however, FAA's long-term forecasts have generally proven to be too high, and they may still be too high. This raises questions about the usefulness of FAA forecasts as a guide to long-range planning and investment decisions. For example, FAA forecasts increased delays at several air traffic control centers in the near future. This forecast underlies the proposed approach to en route computer replacement, a decision that sets the pace and direction for overall system modernization. That decision, if taken, may unjustifiably limit the options available for the final system design.

OTA's review indicates that the growth projected by FAA may well occur ultimately, but there is such uncertainty that any program for upgrading the system should emphasize a flexible design that can be adapted to less growth, or more growth, without a fundamental change in the system. In addition, to the extent that FAA forecasts overestimate future traffic levels, they may also overestimate the user fee revenues that will be collected to pay for the proposed improvements.

SPECIFIC TECHNOLOGIES

The current ATC system, in both en route centers and terminal areas, is based on the technology of the 1960's. Technology has made rapid strides since that time, and there is wide agreement that the present ATC system should be upgraded or replaced. At the same time, there is disagreement about what steps should be taken and how rapidly they need to be implemented.

System Design and Transition

FAA has chosen to move from the present ATC system to the new one by small overlapping steps. The FAA Administrator has stated that, while there is no risk-free way to go from the present system to a new one, this incremental approach minimizes risk at each stage of the transition. Although it reduces some kinds of risk, the incremental approach proposed by FAA does introduce a possibility of an entirely different kind of risk--the risk that hardware choices made in the first stages will limit the options available for the final system design.

Several experts have suggested that overall needs would be better served if FAA made minimum modification to the present system to meet short-term needs, while proceeding with design and deployment of an entirely new system to meet long-term needs. Advocates of this "clean sheet" approach agree emphatically with other experts that the present system must eventually be entirely replaced, and that the first steps in this process should be undertaken as soon as possible. However, they call for a strategy that separates short-term remedial measures from the design of a long-term replacement. They believe FAA should find a cost-effective way to shore up the present system with the intent of discarding it altogether when the new system comes on line. A specific illustration of this approach can be seen in the area of computer replacement.

En Route Computer Replacement

FAA's plan for replacing the en route computer system consists of four steps to be carried out over the next decade:

(1) replacing the present computers with new computers that will operate with the existing software (i.e., the programs and operating instructions for the computer) -- this is called "rehosting" and is scheduled for completion by 1986;

(2) replacing the present display units (called "sector suites") used at controller work stations, scheduled for the late 1980's;

(3) replacing the existing software with new software that will be compatible with the "host" computers bought in Step 1, also scheduled for the late 1980's; and

(4) adding new, more automated functions sometime after 1990.

FAA's proposed "rehosting" approach was criticized by several experts at the OTA Conference on the grounds that it could limit the options for the design of the new software and the addition of new functions. In their view, the new "host" computer should be considered an interim replacement, to be discarded by 1990 when the new system comes on line. FAA maintains that it has no intention of discarding the host computer, which will continue to serve as the basic processor for the ATC system until well into the 1990's.

An alternative short-term approach might be to make selective enhancements to the present technology--that is, upgrading the current computers in the centers where there are capacity problems--while proceeding with a parallel effort to develop a totally new system design, one that makes use of the best available technologies and that will serve into the next century.

Let me explain further. The computers now used in en route centers are assemblies of IBM equipment called 9020A and 9020D, built specially for FAA. The chief differences between the two types of equipment are that the 9020D has more computing power and a larger memory than the 9020A.

An alternative to buying new "host" computers now for the entire en route system is to increase the capacity only at those centers that will soon begin to experience traffic overloads. These are the 10 centers now equipped with 9020As. The centers equipped with 9020Ds will have adequate capacity to meet projected demand until the early 1990's. This capacity increase could be accomplished by converting the 9020As to the more powerful 9020Ds. This conversion requires installing at each center three central processing units called IBM 360/65s.

FAA has explained that an important reason for rejecting the alternative of converting 9020As to 9020Ds was that the agency could not locate a sufficient number of IBM 360/65s to carry out conversions at 10 centers. OTA believes there is an ample number of 360/65s available as used equipment on the open market. Further, an inquiry to the General Services Administration showed a total of 103 IBM 360/65s in the Federal computer inventory as of April 6, 1982. Of these, 13 have already been declared surplus, and others could be made available by replacing them with more modern equivalents. Experts have assured OTA that these used 360/65s would be suitable for the 9020A to 9020D conversion, and that they they can be maintained to provide adequate service and capacity for the rest of the decade. FAA generally concurred with this view at the OTA Conference.

In sum, FAA has advanced several reasons for rejecting 9020A to 9020D conversion as a solution to near-term capacity problems at en route centers. OTA does not find these reasons persuasive. FAA's own option analysis, presented to the Congress in January, seems to support 9020A to 9020D conversion as a workable alternative -- and perhaps perferable to the rehosting approach proposed in the NAS Plan. On the basis of cost and timing, 9020A to 9020D conversion seems superior. FAA estimates conversion to 9020D would cost $64 million and could be completed by 1984. Rehosting would cost $250 million and take 2 years longer to carry out -- that is, not before 1986.

This is not to argue that the rehosting approach is necessarily ill-advised. Rehosting would provide ample computing capcity for 1990 and beyond, and it would provide a more modern and reliable computer upon which to base further system improvements. However, by acquiring a replacement that must be compatible with the present software and centralized system architecture, FAA may be limiting the degrees of freedom available for developing a distributed architecture for the system that will be put in place after 1990. For the Congress, further clarification of the tradeoffs by FAA is essential to reaching a sound decision on the question of computer replacement.

OTA also has some reservations about the procurement strategy selected for modernization of the en route system. Two major procurements are involved--one for the host computer, the other for new software and sector suites. FAA's proposed strategy is a complicated process that entails choosing from all competitors two "finalists" for each of the two procurements. These finalists will then be asked to demonstrate their proposed system at the Test Center in Atlantic City, after which a production contract will be awarded to one of each pair.

Thus, FAA is placing itself in a position where it must manage four major contractor efforts at the same time. The work of these contractors, and possibly several subcontractors, must be coordincated and kept on schedule. Equally important, the contractors must be kept insulated from each other to preserve competition and protect proprietary information. A less complicated strategy might have better chances of success, given the management problems inherent in this approach. If FAA concludes that its proposed approach is to be preferred, then--as a minimum--the agency should take additional steps to increase its internal capability (or strengthen the role of an outside system integration contractors) in the area of system acquisition management.

Automation and Human Factors

The present ATC system is very labor intensive and, without significant increases in controller productivity, the cost of operating the ATC system could rise sharply as traffic grows. FAA looks to increased automation as the principal means of achieving higher levels of controller productivity and holding down labor costs.

The Automated En Route ATC System (AERA), which is scheduled to be implemented in the early 1990's, would change the role of the controller from that of an active participant in the control process to that of a manager who oversees that operation of a highly automated system. Many of the routine decisionmaking functions now performed by humans would be automated, with the result that fewer controllers will be required for a given level of traffic.

Human factors and safety are important concerns in AERA. In a highly automated system it might be difficult to assume to manual control in the event of a system failure or to take the necessary corrective actions in time. Therefore, the AERA concept assumes that the functions of the future ATC system will be distributed among various elements. In the event that the main computer at a facility fails, auxiliary computers (acquired during the second phase of system modernization) will contain enough processing power to provide at least some backup functions; other functions will be transferred in real time to neighboring centers that remain operational. In other words, the backup to automated operation will be another equally automated form of operation.

FAA recently commissioned five analytical studies of the AERA concept. Four of the five generally agreed with the proposed plan. The fifth, conducted by the Rand Corporation, suggests that the AERA concept of automation may not be desirable either from the standpoint of safety or from the standpoint of human factors -- the controllers ability to participate effectively in such a highly automated system and to take effective and prompt remedial action if a computer breakdown occurs. OTA believes that FAA's plans for automating the future ATC system will require close and continued examination by disinterested technical experts.

Satellite Technologies

FAA does not foresee a role for satellites in the ATC system before the end of the century. This technology has developed rapidly over the past few years, and satellites have considerable potential not only as a communication resource but also for use in surveillance and navigation.

FAA does envision that satellites could eventually have a role in providing ATC services to aircraft operating over land, but the agency believes they are not yet a cost-effective alternative to ground-based systems. In the near term, there may be greater potential for using satellites to provide services to aircraft operating over large bodies of water, where only minimal services are now available.

Satellites could also be used to improve surveillance. The area covered by ground-based radar is limited by terrain, and it would be very expensive to provide for full coverage of U.S. airspace using ground sensors alone. Surveillance satellites, working in conjunction with the Mode S data link and ATC computers on the ground, could determine aircraft position and provide the basis for separation services. This would be particularly useful in resolving the problems that arise in providing coverage at low altitudes where small GA aircraft sometimes share the airspace with high-speed military jets on training missions.

Satellites can also serve as aids to navigation. The military Global Positioning Satellite system is partially deployed and, when completed, could be used to provide navigational fixes with the same (or higher) accuracy as now afforded by ground-based navigation aids. FAA apparently omitted navigation satellites from the 1982 NAS Plan on the basis of timing. The preparatory work necessary to bring satellite navigation services for civil aviation to an operational status could not be completed before the end of the present decade, when FAA plans to have the essential parts of the new ATC system in place. Slippages in FAA's proposed deployment schedules, however, could reopen the satellite option.

IMPACTS ON AIRSPACE USERS

The proposed ATC system improvements are directed primarily to the needs of IFR traffic; they also benefit FAA itself by automating functions and reducing labor costs. The principal user benefits will be for air carriers and larger business aircraft. Some general aviation (GA) users have expressed reservations about the FAA plans. Personal GA users will receive improved weather information, a major benefit, but there will also be greater restrictions on their access to airspace, and they will be required to buy more avionics to receive full ATC services.

The Department of Defense (DOD) also has concerns. DOD is both a major user and joint administrator of the national airspace. Yet, the 1982 NAS Plan appears to have been developed without consultation with DOD. DOD has expressed concern about the effect of planned FAA actions on the interface between military and civil ATC systems. DOD feels that some of the improvements proposed by FAA either will not add to military mission capability or may impose more costs than benefits on the military users.

DOD estimates the cost to equip military aircraft with Mode S alone will exceed $1 billion. These costs, which will ultimately be borne by the general taxpayer, must be balanced against whatever benefits Mode S has for military and civil aviation. Costs to equip military aircraft with TCAS (the collision-avoidance system selected by FAA for civil aviation) will also be high, and DOD has expressed concern about the effects that the aircraft antenna required for TCAS might have an the aerodynamic performance of certain military aircraft.

COST AND FUNDING ISSUES

The costs of implementing the 1982 NAS Plan over the next 5 years would lead to substantial increases in the FAA budget for facilities and equipment (F&E). According to budget estimates released by FAA Administrator Helms on March 17, 1982, in testimony before the Aviation Subcommittee of the House Committee on Public Works and Transportation, the F&E costs for the period FY 1983 to FY 1987 would amount to slightly over $6 billion. Thus, future F&E costs would be nearly three times higher than historical levels, in constant-dollar terms. Cost estimates for the NAS Plan in the years beyond 1987 have not yet been released by FAA, but it seems likely that annual expenditures of roughly equal magnitude would be needed through the early 1990's in order to complete modernization of the ATC system, install a new communication network, and upgrade air navigation facilities.

Statements by the Administration tie implementation of the Plan very closely to funding issues. FAA Administrator Helms has indicated that the success of the Plan depends heavily upon securing a long-term funding commitment at the outset. The proposed method of assuring a stable and reliable source of funds is a system of user fees that would recover 85 percent of the FAA's future capital and operating costs from those who receive ATC services.

The burden of cost recovery would not fall equally on each class of airspace user, however. Recovery from air carriers through the passenger ticket tax would vary from 104 to 148 percent of the costs allocated to them by FAA. The proportion recovered from general aviation (GA) as a whole would be between 12 and 20 percent of their allocated share. Thus, GA would apparently receive a substantial cross-subsidy from air carriers (more properly, from airline passengers and shippers of air freight).

There may also be an additional cross-subsidy within general aviation. That part of the GA fleet made up of turboprop and jet business aircraft operates in the IFR system much of the time and is used in a manner similar to air carriers--point-to-point flights, into and out of major airports, under IFR, and receiving full ATC services. These business aircraft now constitute about 60 percent of all GA traffic in the IFR system and represent 30 to 35 percent of the total workload at FAA towers and en route centers. Business aviation is also the fastest growing segment of civil aviation.

However, the Administration's proposed user fees do not allocate costs differentially among GA classes. Business aircraft making extensive use of the IFR system would pay essentially the same fuel taxes as small GA aircraft that are used for personal and pleasure flying and make little use of the IFR system. Thus, business aviation would appear to receive a cross-subsidy from personal aviation.

If equitable cost recovery is to be the principle, a cost allocation formula should take into account the significant differences in the burden placed on tower and en route facilities by the various segments of the GA fleet. The Administration proposal does not do so.

As a postscript, I would like to add that the OTA critique is only one step in the review of the NAS Plan by Congress and the aviation community. While some of the comments I have offered today have been pointed, they certainly should not be construed as taking credit away from what Mr. Helms and the FAA have set out to do in the NAS Plan. Mr. Helms' efforts in bringing order to an enormously complex enterprise speaks for itself. The observations I have offered today are intended to be constructive, and in that spirit I look forward to this Committee's and the FAA's response.

Mr. GLICKMAN. I would like to ask Dr. McLucas this question—I think both of your statements are very good statements. At this stage, this committee's function is to basically advise the House on the R. & D. aspects of what the FAA is proposing and authorize the front-end moneys, which are not the big ticket items. That will occur in other committees.

But it is inevitable that technology will change and that, the longer you wait in making your techology selection, the greater the chance that more advanced technology will be available. It looks like OTA seems to be caught up in this dilemma in reaching a majority consensus on the best computer replacement. Your conference cites that the best way to proceed with it is a judgment call. If the votes are so close on the difficult options and if the FAA forecasts are reasonably accurate—by the way, I think that, for the most part, the FAA forecasts in recent years have been reasonably on target, reasonably so—doesn't it make sense to proceed as the FAA has recommended rather than stay caught up in an endless debate, another 20 years of just more and more talk about, "Well, we have patched this item up and we patched this item up"? It is more of a devil's advocate kind of question.

Mr. MCLUCAS. Well, I think it has been demonstrated many times, Mr. Chairman, that this particular type of procurement inside the Government is one of the most difficult to pull off properly. During my time with the Air Force, I had very poor experience in that regard. We seemed to be able to build better airplanes than we could computers. So, the last thing I want to say is that I have a lot of experience in exactly how to do this properly.

I would agree with you that, if it is a close call and the experts are all still in disarray after considerable attention devoted to this subject, we might as well take the FAA plan and proceed. The impression I have is that they have not done any huge amount of work to justify the specific approach that was taken. In fact, I believe that if you could talk to the individuals themselves at FAA, you would find that perhaps some of the other alternatives which were considered have a very strong body of support within FAA. So I don't think that those of us who were somehow criticizing the FAA approach are being sacrilegious.

The problem is that the whole topic has been fraught with so much difficulty in the past. We would like to see a good substantiation that the proposed plan is, in fact, the best plan available. I don't want to claim that I am a computer expert. I am not, and I have concluded that I never will be.

But I think that the one thing which has a bearing on both what Dr. Andelin said and what I probably should have said and didn't is that the FAA is an ongoing operation. We can't say, Close down while we run this experiment. If it works, we will come back onstream. We have to keep the system going. Therefore, some sort of a phased approach is the only logical way to go.

I was not persuaded that this idea of upgrading the 9020A's to 9020D's is all that difficult. I felt that it was a logical alternative that should be given serious consideration. If the computer experts decide, after a reasonable amount of time, that the FAA plan is the best way to go, I certainly wouldn't argue with that.

Mr. GLICKMAN. I guess my question is that computer experts are like economists, you will probably find computer experts to say whatever you want to and, if they are related to certain companies—the first witness today was Mr. McCloskey from the Electronic Industries Association. I assume he is just really ready to go "gang busters" on the big plan. You will probably find other computer experts that are in the modification area.

What I am saying is that I am not sure that there isn't a point of accuracy in what you are stating. I think the Administrator came up with a plan primarily because, I think, he was frustrated and there hadn't been a plan. He was motivated, I think, in large part, because of this committee's interest in collision avoidance systems. I think he came to the conclusion, as I recall, that collision avoidance systems could not be implemented independent of larger issues of moving aircraft around from one part of the country to the other. So he came up with a general plan to try to deal with that situation.

I also recognize that his general plan departed from the historical FAA push on where the air system plan should go. What I am trying to figure out is—OK, now we have the OTA assessment, and I think your report is a useful one because it will cause the FAA, maybe, to go back and review it—but what other reviews should we be doing? Who should we be calling in? Should the FAA have some sort of a super blue ribbon Computer Advisory Committee that goes over with them on this thing?

Mr. MCLUCAS. I have to go back into history, but one of my last acts was to set up a Technical Advisory Committee at FAA. I was hoping that, in the future, they would be able to deal with questions such as the one you just asked. I don't know whether that committee has ever gotten very far. I think it was dismantled shortly after my departure. This shows the problem of continuity in Government.

But, in any case, I would think that your committee, Mr. Chairman, probably should not try to get too deeply involved in the fine points of the decision on how best to buy those computers. What your committee should do is see that the FAA itself calls in experts and gets a variety of views before deciding finally how best to make the decision but I wouldn't want to see this thing delayed too long.

Mr. GLICKMAN. Mr. Dunn.

Mr. DUNN. Just let me add something to that thought—and I also want to refer to your statement, on page 4—it seems to me that this Administrator has already done that, in that in this proposal, he has, for the first time, and as the chairman says, in 20 years taken a look at what the needs of the system are and then said we will design the equipment around that, rather than, as in the past, saying here is a new piece of equipment, how do we make it fit into there.

I have some reservations about what you say on page 4 about—I would agree with your statement that the FAA hasn't been particularly successful in deciding which new system to handle, or whether they even have the capability to make those kinds of judgments.

Mr. MCLUCAS. Yes.

Mr. **DUNN**. But you suggest here that they should hire a major engineering contractor to actually design this system. I don't know how you would actually implement this plan here. It calls for a system of bids to go out—I think it is with five, and then down to three, and then down finally to one prime contractor. By everybody's agreement, there are probably only three or five companies in the country that could handle it anyway.

So, as an outside expert that you suggest being hired, are you going to take one of those five companies? I have some reservations on how you would ever implement that in terms of the other bidders.

Mr. **MCLUCAS**. Mr. Dunn, I don't agree that is what I said here.

Mr. **DUNN**. OK. What were you saying? You said a major system engineering contractor.

Mr. **MCLUCAS**. A system engineering contractor is different from a computer design house. What I am talking about is making sure that the big pieces fit together, that the interfaces haven't been forgotten, and that the pieces will actually fit together and work together.

I assume that the FAA is responsible for the total design. I am saying that they can't subcontract design responsibility, but they can use extra hands and brains to help them through the systems analysis.

Mr. **DUNN**. OK. I guess that maybe the only difference in what we are seeing then—I would agree that the FAA doesn't have the register of engineering brains on board now to make those decisions. But, rather than hire an outside contractor to fill that role, hire a few more people who have those capabilities and design a system, and then let it out under a general bid basis rather than pulling one of those prime contractors or an outside consultant. I guess that is the only difference between what we are saying.

Mr. **MCLUCAS**. I agree with what you just said.

Mr. **DUNN**. OK. Thank you very much.

Mr. **GLICKMAN**. I want to thank you for your testimony.

Yes, Dr. Andelin.

Mr. **ANDELIN**. I would like to make a comment on OTA's suggestion about the alternative approach of conversion of 9020A's to 9020D's. In no way are we saying that the efforts to develop and procure the system for the 1990's should be delayed as a result of this short-term patch. We say very specifically in our report that the current computers in the centers with capacity problems should be upgraded while proceeding with a parallel effort to develop the totally new system design.

This was an option presented by FAA in January when they suggested that the A-D conversion was practical. We are saying that in meeting the short-term capacity problem by means of rehosting, one should be sure that the new computer will not constrain unduly the system of the 1990's. Before making a commitment to rehosting, one should also be sure that the alternative—upgrading 9020A's to 9020D's while undertaking a whole new system for the 1990's—is not in fact as good, perhaps cheaper, perhaps faster, and perhaps more versatile. We are not suggesting FAA slow down the overall process of system modernization.

Mr. **Glickman**. I guess one of the concerns that I would have is just the way Government works—and Dr. McLucas has been in Government long enough to know this—if you make an interim solution, you may just have axed any possibility for the long-term solution in the 1990's, just institutionally. That is something that, of course, we can't determine right here, whether that would happen or not.

Mr. **Andelin**. That could happen with rehosting, too. It also is an interim solution.

Mr. **Glickman**. I could. I don't know.

Mr. **Andelin**. Rehosting is an interim solution with greater expenditure.

Mr. **McLucas**. Could I make an additional comment?

Mr. **Glickman**. Sure.

Mr. **McLucas**. It seems to me that the most critical item in this whole process is to get a good manager and put him in charge. I notice that NASA has just taken on Jim Abramson to manage the Shuttle program. FAA needs a Jim Abramson for this program.

Mr. **Glickman**. I think that is a good point.

We thank you very much for your testimony today. We appreciate the work of OTA on this.

The hearing will be adjourned, and we will mark up the FAA portion of this bill on Tuesday.

[Whereupon, at 11:03 a.m., the subcommittee was adjourned.]

APPENDIX

Additional Statements Submitted for the Record

Statement of John L. Burton on FAA's National Airspace System Plan At Hearings Before the Transportation, Aviation and Materials Subcommittee of the Committee on Science and Technology

April 28, 1982

Mr. Chairman, I want to thank you for inviting me to sit with the subcommittee today. The Government Operations Committee's Subcommittee on Government Activities and Transportation, which I chair, has a long-standing interest in matters pertaining to the safety and efficiency of the National Airspace System and has issued many reports on this subject.

One of the things I have noticed during my tenure as Chairman is that FAA has tended to approach the National Airspace System much like the six blind men approached the elephant, each one grabbing on to a different part of its anatomy and forming his opinion of the whole from that one part. Consequently, there has not been a well thought-out long-range coordinated plan for future development of the National Airspace System. This deficiency has, in turn, led to innumerable false starts, abrupt shifts, start overs, and failures in attempting to develop various aspects of the system.

I want to salute the Chairman and other members of this subcommittee for taking the initiative in obtaining passage of House Resolution 202 directing FAA to submit a preliminary plan for the future Enroute Air Traffic Control Computer System in a timely fashion. Our subcommittee had made a similar recommendation in a report issued last June. The proposed new computer system appears to be the cornerstone for the entire future system plan, which FAA has now proposed.

Without endorsing the specifics of the plan, I would also like to compliment Administrator Helms for putting together such a comprehensive plan within a relatively short time after assuming his position.

Mr. Chairman, I would like to compliment you for taking the initiative in holding this series of hearings so that the Congress can get an early start in evaluating and hopefully perfecting the proposed plan so that the process of modernizing the Air Traffic Control System can proceed.

HAVING PAID ALL THOSE COMPLIMENTS, I AM SORRY TO SAY THAT I HAVE SOME RATHER DISTURBING NEWS TO CALL TO THE ATTENTION OF THIS SUBCOMMITTEE. ONE OF THE RECOMMENDATIONS IN OUR SUBCOMMITTEE'S JUNE 1981 REPORT ON AIR TRAFFIC CONTROL COMPUTER FAILURES WAS THAT THE COMPTROLLER GENERAL INITIATE A COMPREHENSIVE INVESTIGATION OF FAA'S PLANNING, MANAGEMENT, AND ACQUISITION OF AUTOMATED INFORMATION SYSTEMS FOR AIR TRAFFIC CONTROL AND MANAGEMENT PURPOSES. BECAUSE FAA'S PROPOSED $10 BILLION PLAN ENCOMPASSED SO MANY SUCH SYSTEMS AND FAA WAS REQUESTING IMMEDIATE CONGRESSIONAL APPROVAL AND FUNDING, WE ASKED GAO TO GIVE US AN INTERIM REPORT EVALUATING THE PLAN.

IN THAT REPORT, WHICH HAS JUST BEEN RECEIVED BY THE SUBCOMMITTEE, GAO ACKNOWLEDGED THAT FAA'S PLAN IS A STEP IN THE RIGHT DIRECTION, BUT IT ALSO POINTED OUT A NUMBER OF SHORTCOMINGS IN THE PLAN AND ITS PROPOSED IMPLEMENTATION AND CONCLUDED THAT THE NAS PLAN SHOULD NOT BE VIEWED AS THE BASIS FOR APPROVING BUDGETARY AND IMPLEMENTATION ACTIONS.

SOME OF THE MORE SIGNIFICANT CRITICISMS OF THE PLAN ARE THAT IT:

--DOES NOT INCLUDE COST INFORMATION ON INDIVIDUAL PROGRAMS, PROJECTS OR SYSTEMS WHICH IS REQUIRED TO ASSESS ITS COST EFFECTIVENESS;

--PRESENTS ONLY ONE APPROACH, MAKING IT IMPOSSIBLE TO DETERMINE WHETHER IT IS THE MOST COST EFFECTIVE;

--LACKS SUFFICIENT DETAILS TO VERIFY THE SAVING AND BENEFITS CLAIMED;

--USES QUESTIONABLE ASSUMPTIONS ABOUT THE GROWTH OF FUTURE AIR TRAFFIC;

--DOES NOT DIFFERENTIATE BETWEEN DECISIONS THAT MUST BE MADE IN THE CURRENT FISCAL YEAR AND THOSE THAT COULD BE DEFERRED.

THE REPORT ALSO NOTED THE LACK OF ANY TRANSITION PLANNING FOR MOVING FROM THE CURRENT SYSTEM TO THE NEW ONE.

"WITHOUT SUCH PLANNING," IT SAID, "SIGNIFICANT DIFFICULTIES CAN BE ENCOUNTERED WHICH COULD CAUSE UNACCEPTABLE RISKS AND SERIOUS CONSTRAINTS ON AIR TRAFFIC."

OTHER PROBLEMS THAT MIGHT ARISE IN THE IMPLEMENTATION PROCESS WITHOUT APPROPRIATE TRANSITION PLANNING ACCORDING TO THE REPORT ARE THAT:

—CERTAIN ATC AND LANDING SYSTEMS MAY BE PROCURED PREMATURELY BECAUSE FAA PLANS TO BUY EQUIPMENT BEFORE NEGOTIATIONS ON INTERNATIONAL AGREEMENTS ON THESE MATTERS ARE CONCLUDED;

--CERTAIN PLANNED COLLISION AVOIDANCE EQUIPMENT WILL NOT BE EMPLOYED IN AREAS WHERE MOST MID-AIR COLLISIONS OCCUR;

--FUTURE COLLISION AVOIDANCE PROTECTION MAY BE EXCESSIVELY DEPENDENT ON A SINGLE DATA LINK SYSTEM WITHOUT ADEQUATE BACKUP;

--INTERIM COMMUNICATIONS SWITCHES SCHEDULED FOR ACQUISITION MAY NOT BE COST EFFECTIVE BECAUSE THEY WILL BE USED FOR ONLY A SMALL PORTION OF THEIR LIFE EXPECTANCY;

--THE COST EFFECTIVENESS OF THE TREND ANALYSIS PORTION OF REMOTE MAINTENANCE MONITORING HAS NOT BEEN VERIFIED.

GAO ALSO SAID IT HAD SERIOUS CONCERNS ABOUT THE ABILITY OF FAA'S TOP LEVEL MANAGEMENT TO CARRY OUT SUCH A COMPLEX PLAN. IT CITED THE AGENCY'S PAST HISTORY OF MANAGEMENT FAILURES, PARTICULARLY IN THE ADMINISTRATION OF COMPUTER OPERATIONS, AND STATED, "WE BELIEVE THESE PROBLEMS ARE SERIOUS AND DIRECTLY IMPACT FAA'S ABILITY TO SUPPORT THE NATIONAL AIRSPACE SYSTEM."

ONE OF THE MOST DISTURBING FINDINGS IN THE GAO REPORT IS THAT THE NAS PLAN DOES NOT MENTION THE FACT THAT THE NEW HOST COMPUTER MAY NOT BE ADEQUATE TO IMPLEMENT THE AUTOMATED ENROUTE AIR TRAFFIC CONTROL (AERA) CONCEPT PROPOSED FOR THE 1990'S AND THAT EITHER AUGMENTATION OR TOTAL REPLACEMENT MAY THEN BE NECESSARY AT A POTENTIAL COST OF $500 MILLION. YET THIS POSSIBILITY IS ACKNOWLEDGED IN FAA'S RESPONSES TO REPORTS BY OUR SUBCOMMITTEE AND THE SENATE COMMITTEE ON APPROPRIATIONS ON FAA'S CURRENT ENROUTE AIR TRAFFIC CONTROL COMPUTERS.

AS A RESULT OF ITS FINDINGS, GAO CONCLUDED THAT THE NAS PLAN SHOULD BE AMPLIFIED, PERIODICALLY UPDATED AND PROVIDED TO THE CONGRESS AS AN AID IN PREPARING FOR FISCAL 1984 BUDGET DELIBERATIONS.

MR. CHAIRMAN, I ASK THAT THE GAO INTERIM REPORT BE INSERTED IN THE RECORD OF THE HEARINGS, AND I HOPE THAT IT WILL BE USEFUL TO THIS COMMITTEE IN ITS DELIBERATIONS ON THE PROPOSED NATIONAL AIRSPACE SYSTEM PLAN.

NATIONAL AERONAUTIC ASSOCIATION
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AREA CODE 202 347-2808 • CABLE—NATAERO • TELEX 64149
UNITED STATES REPRESENTATIVE FEDERATION AERONAUTIQUE INTERNATIONALE

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April 27, 1982

Honorable Dan Glickman
Chairman
Subcommittee on Transportation,
Aviation and Materials
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Chairman Glickman:

It is requested that the enclosed statement of NAA be made part of the record of your hearing this week on the National Airspace System Plan.

I would be pleased to elaborate with you personally or at any future hearings on this subject.

My best in the meantime.

Sincerely,

Clifton F. von Kann

Clifton F. von Kann
President

Identical Letter to Honorable Barry M. Goldwater, Jr.
cc: All Members of the Science and Technology Committee

NAA's VIEWS ON AIRWAY AND AIRPORT IMPROVEMENT - and Its Effect on U. S. Aerospace Leadership

The National Aeronautic Association has as a prime goal the maintenance of United States leadership in air and space. We believe that such leadership is essential to U.S. national security, economic progress and adequate employment levels. NAA is not obligated to any given segment of aviation; rather, we take a broad approach to how aviation can best serve the needs of the Nation and the public. We have no other criteria.

Among the issues which materially affect the future of U.S. aerospace leadership is the requirement for an airway and airport system that is safe, economical and adequate to meet public demand. The Administration, the Congress and the various segments of the aviation community are now engaged in a public debate on how such an airway and airport system can be achieved and financed. This debate is of major importance because an adequate airway and airport infrastructure is vital to an efficient air transport system, prosperous airlines under private management, new aircraft orders, and successful competition in world aircraft markets by the U.S. aerospace industry.

For many years a long range plan for modernizing the airway and airport system was lacking. This caused obsolescence in the existing system with attendant loss of efficiency, increased maintenance costs, escalating delay penalties and the prospect of major system breakdowns within the next few years. Recently, however, the FAA Administrator produced a well thought out system plan for transitioning from the present system to a modernized system which would utilize available technology, meet public demand and reduce system costs by tens of billions of dollars over the coming 20 years.

This plan has provided the U.S. with a great opportunity. If there were agreement among the Administration, the key Congressional committees and the various aviation segments, financing for the new system could be established and implementation could be initiated in time to avoid the major breakdowns which are only a few years away.

Unfortunately such agreement has not as yet been achieved. This lack of agreement creates a threat that nothing will be done and that a vital foundation of U.S. aerospace leadership will suffer further decay.

In this situation it is incumbent upon the National Aeronautic Association as a group without parochial interests to state its views on what should be done in the best interests of the Nation and the public. It is our earnest hope that this statement will lead to the consensus which is so badly needed to seize the opportunity at hand.

THE NATIONAL AIRSPACE SYSTEM PLAN

The National Airspace System Plan is the most comprehensive plan of its kind ever developed. More important, it is the work of the duly appointed official responsible for the safe and efficient use of the national airspace. Finally the unique qualifications of Administrator J. Lynn Helms, and the fact that he personally served as project leader, guarantee that the plan is viable.

This does not mean that the plan is inviolate. No 20 year plan can be, and mid-course corrections are always necessary in programs of this type. However, the thrust of the plan has been widely endorsed; and no other can give the public and the Congress comparable assurance of achieving the objective.

Unfortunately the plan has already been subjected to some second guessing by self-styled "experts". An example of this is the recent statement of the Office of Technology Assessment which is critical of the FAA Plan without, apparently, understanding the Plan itself. Such irresponsible action occurs all too frequently. It must be remembered, however, that none of these "experts" has FAA's responsibility for safe and efficient operation of the airways, and none has Administrator Helms' qualifications. Therefore, these suggestions and criticisms cannot be permitted to delay long needed action proposed by competent and responsible authority.

On one point, however, there is universal agreement. The modernization of the airspace must be accompanied by an airport program which maintains a phased build up of airport as well as airway capacity. Special emphasis must be given reliever airports and heliports in order to maximize use of the air carrier type facilities.

> NAA POSITION: The FAA National Airspace System Plan, accompanied by a phased build up of airport capacity, is the best solution to the problem of airway and airport capacity and should be implemented.

FINANCING AND IMPLEMENTING THE NEW PROGRAM

Implementation of the National Airspace System Plan is estimated to cost about $10 billion during the next decade. The bulk of this money (80-90%) will be raised by increasing the airline ticket and waybill taxes. These increases have been agreed to by the airlines. In addition the airlines are prepared to accept these taxes at a sufficiently high level to fund a renewed airport development aid program at roughly the levels previously agreed upon by airport operators. The airlines' acceptance of this commitment, however, is contingent upon abandonment by the government of airport defederalization and head tax proposals. Most aviation groups support the airline position.

Thus the main components of a system plan and a financing plan are in place or could be put in place. Unfortunately, a number of less important but still unresolved issues are slowing down the legislation needed to implement the program. These issues are:

- The need for a multi-year authorization.
- Proposals for voluntary airport defederalization accompanied by head taxes.
- The level of the general aviation fuel tax.
- The percentage of FAA Operations and Maintenance to be funded from user contributions.
- Concerns about cross-subsidy.
- Differing views of the two Houses of Congress.

The NAA positions on these issues are discussed below.

NAA POSITIONS

On Multi-Year Authorizations: The aviation community is in complete agreement that the airway and airport program must be launched as a multi-year program - five years as a minimum. The rationale for this view is that no long range program can survive the annual budgetary tug-of-war and that programming year by year will discourage commitment and investment by those who are expected to be participants in the program. The interested committees of the Congress seem to be sympathetic to a multi-year approach.

On the other side, the OMB, as a matter of principle, opposes authorizations for so-called out-year expenditures and therefore opposes the multi-year approach.

NAA POSITION: The arguments supporting the multi-year approach are valid. The history of the Airport and Airway Development Program demonstrates that a year by year approach would have a high probability of killing this vitally important program. On the other hand multi-year authorization would not prevent OMB from doing its job. Therefore, the multi-year approach should be adopted, and initial authorization should cover the next five fiscal years.

On Airport Defederalization and Head Taxes: Defederalization of the major airports was originally proposed on the theory that the airlines and major airport operators could negotiate as equals. This concept was rejected by the airport operators who insisted that a guaranteed source of funding (i.e. head taxes) must be part of the defederalization scheme. Thus the concept of defederalization evolved into the present proposal for voluntary defederalization with head taxes authorized in those cases.

The airlines and most elements of the aviation community oppose defederalization and head taxes. They consider that its implementation would create numerous problems, many of which cannot even be foreseen. Relations between defederalized and non-defederalized airports would certainly be complicated, and tax collection procedures would be administrative nightmares. Nor is it clear how many airports really want defederalization.

The airlines consider that since they, their passengers and their shippers will be footing the bulk of the bill for airport and airway modernization (and since some federal support will be required for airports in any event), they should not be subjected to the additional uncertainties and costs of head taxes for those airports which choose defederalization. They have therefore proposed a sufficiently large ADAP program, financed by the users of the system, to cover all user financed airport development outlays.

The two houses of Congress differ on defederalization, and it is unlikely that defederalization legislation can make its way through the legislative process.

> NAA POSITION: Defederalization is no longer the progressive concept which it originally was. In its present form it presents numerous problems which should be resolved before it is seriously considered. It is unlikely to be accepted by the Congress. The airport operators are recipients, not providers, of funds; their position is one of dictating how the funds shall be provided to them. The airline proposal would provide the required airport development funding without the uncertainties and risks of defederalization. It should therefore be accepted.

On the General Aviation Fuel Tax: The various general aviation groups have different views on this subject. These in turn differ from the Administration proposals. The principal point to remember is that the difference between the high and low fuel tax proposals are not sufficiently significant to affect the success of the program. Therefore the issue is not a significant one, and it should not be regarded as such.

> NAA POSITION: The middle of the road proposal appears to be for a non-escalating tax of 12¢/gallon for general aviation gasoline and 14¢/gallon for general aviation jet fuel. This appears to be a reasonable compromise.

On FAA Operations and Maintenance: This long standing debate has dragged on because of the inability of past Congress and Administrations to resolve the public benefit issue. Present proposals range from a 25% to an 85% user contribution, with the larger number placing a very heavy part of the modernization burden on the airline passengers and shippers. All proposals set the OMB contribution of the users considerably above the levels which obtained under the Airport and Airway Development Program of the seventies.

NAA POSITION: Set the O&M contribution at 50% for the first year of the program and reconsider the matter when the actual costs of the modernization program become more firm.

On the Cross Subsidy Issue: This is a non-issue which puts economic theory against practical necessity. There is no practical way to eliminate some amount of cross subsidy in the airway and airport system. Therefore, its existence is not a valid criticism of current financing plans. In the airline proposal it is noteworthy that the providers of the so-called subsidy are not objecting to its existence - as long, presumably, as the subsidy is not excessive.

NAA POSITION: Disregard the subsidy issue.

On the Differing Views of the Houses of Congress: While these must finally be resolved in Conference, and while most involved members of the House and Senate recognize the urgent need to get the modernization program funded and under way, it is nevertheless a fact that procedures and protocol "on the Hill" make it extremely difficult for the Congress to resolve present differences. Yet the Congress may be the only player in the drama that can bring matters to a conclusion that protects U.S. aerospace leadership and the public interest.

NAA POSITION: The appropriate congressional committee chairman should collaborate and exert every effort to bring this program to Conference and final enactment during the current session.

CONCLUSIONS

The most serious roadblock is the impasse between the airlines and airport operators on defederalization and head taxes. Since the airlines and their passengers and shippers will be providing nearly all the funds for the program, since defederalization and head taxes will create numerous problems, and since it is unlikely that a defederalization bill can be passed by both Houses of Congress, NAA supports the airline position as the only way to move forward and avoid further delay in providing needed system capacity. Most aviation groups support the airline position.

What is needed now is for all parties concerned to recognize that implementation of the National Airspace System Plan with a substantial airport development program is vital to U.S. aerospace leadership and that without such a program our airway and airport system will soon become inefficient and excessively expensive.

All parties must recognize that no one can have everything his way, but that if first priority is given to the national interest, everyone will gain in the long run. If parochial interests receive first priority, everyone will lose.

ARMED FORCES COMMUNICATIONS AND ELECTRONICS ASSOCIATION

Publishers of SIGNAL - Official Journal of the AFCEA
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Area Code (703) 820-5028

April 21, 1982

Congressman Dan Glickman
Chairman
Subcommittee on Transportation,
 Aviation and Materials
Suite 2321
Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Glickman:

On March 12, you kindly requested that the Armed Forces Communications and Electronics Association (AFCEA) comment on the FAA's National Airspace Systems Plan.

As the most advanced professional society of its kind in Communications, Electronics, Computer Systems and Intelligence Systems, our non-profit, non-lobbying Association is honored by your request. Representing over 20,000 professional top level engineers and scientists of the Free World governments and over 400 industries, we are pleased to assist the United States Congress in its critical review of the subject plan.

In our examination of the National Airspace Systems Plan, it became immediately apparent to us that such a "systems engineering" top down approach to upgrading the National Airspace System is not only needed but also is essential if the capacity of the system is to be safely expanded in the most cost effective manner.

Past FAA procurement practices encouraged the purchase of electronics equipments, particularly communication equipments, from the regional level with each region determining what was required and which equipments should be purchased. This decentralized management led over the years to a variety of equipments performing the same, or nearly the same, function in different regions. Moreover, this practice guaranteed inefficiency and obsolesence.

The past practices have created growing interoperability problems and established a requirement to supply, support and train for a wide variety of equipments. Certainly, a less costly approach is contained in the current FAA National Airspace System Plan. This plan, if supported and funded in a timely manner, can provide for a cohesive National Airspace System (NAS) with safe expansion capability.

Communications-Electronics-Command and Control-Computer Sciences-Intelligence Systems

The above reasons for supporting the current NAS plan become even more important if one considers the rapid, evolutionary movement now taking place into digital electronics technology as well as the planned use of data links to provide information automatically between cockpit and ground, and to furnish accurate surveillance, navigation, weather and flight plan data between control positions on the surface. The standardization of data rates, wave forms and other technical parameters can only be accomplished with a comprehensive plan such as the NASP provides.

This plan provides for automation of many functions currently performed manually. Thus, reliability and flexibility will replace human error and management rigidity. In the case of maintenance and support of the over 900 remote electronics sites now being operated by the FAA, the move to automation will provide remote monitoring, diagnostics and control of many of these systems offering savings of millions of dollars in personnel costs while at the same time providing more reliable and dependable service.

It should be noted that converting to such an automated system, as envisioned, will require a significant increase in capital investment in the near term. However, the overall savings can be substantial over a ten to fifteen year period. Furthermore, the technology required to accomplish the planned tasks is mainly in place, requiring only applications effort to adapt it to FAA requirements. There appear to be few, if any, requirements for major R&D expenditures.

In summary, our initial evaluation of the FAA plan to upgrade the National Airspace System reveals a logical, integrated and well laid-out path that can be supported by current industry technology within reasonable cost. Risks, though present, have been minimized.

The objectives set by the plan for a safe, logical expansion and upgrade of the current system are achievable within the stated time frame provided the required funding and support is forthcoming from the Congress.

The worst possible path to follow would be to piecemeal this "total systems program" or to emphasize one feature of it over another. It is axiomatic that the systems involved must be treated as an integrated and related group. Efforts to maintain personnel levels; i.e., not to phase down people as automation comes in, would offset to considerable extent cost-savings projected. It is with these thoughts in mind that AFCEA stands ready to support the National Aerospace System Plan and the FAA stated approach for implementation.

Sincerely yours,

Jon L Boyes

Dr. Jon L. Boyes
Vice Admiral, USN (Ret)
President, AFCEA

JLB:cl
cc: Mr. Lynn Helms, FAA Administrator
Mr. Albert Albrecht, Associate Administrator, FAA
Mr. Bob Severns, Mgr., Federal Civil Agencies Program, Rockwell Int'l.
Mr. John Hollansworth, Chairman of the Board, AFCEA
Dr. Richard DeLauer, Undersecretary of Defense, Research, Engineering and Acquisition
BGEN Kirby Lamar, Director, Corporate Affairs, AFCEA

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President
Howard E. Johannsen
Executive Vice President
Mark E. Schneider

April 27, 1982

The Honorable Dan Glickman
Chairman
Subcommittee on Transportation, Aviation
and Materials
1507 Longworth House Office Building
Washington, D.C. 20515

Dear Congressman Glickman:

The National Association of Flight Standards Employees (NAFSE) represents employees working in the Flight Standards division of the FAA. In preparation for testimony before your subcommittee, I requested their comments on the FAA's proposed National Airspace System Plan.

After reviewing their comments, I contacted their president, James G. Duea, for permission to have their comments entered into the record so that your subcommittee could review first hand their concerns with the National Airspace System Plan. I therefore request that you enter Mr. Duea's statement into the record for the current hearings being conducted this session. I believe you will find the comments both factual and extremely informative.

I look forward, as does Mr. Duea, to working with your subcommittee for a safe aviation future.

I remain,

Sincerely,

Howard E Johannssen

Howard E. Johannssen
President

HEJ:ab

Enclosures

"We Will Either Find A Way or Make One"

PROFESSIONALS: WORKING FOR AIR SAFETY

NAFSE

NATIONAL ASSOCIATION OF FLIGHT STANDARDS EMPLOYEES
444 NORTH CAPITOL STREET, N.W. SUITE 820
WASHINGTON, D.C. 20001

STATEMENT OF JAMES G. DUEA
PRESIDENT, NATIONAL ASSOCIATION OF FLIGHT STANDARDS EMPLOYEES
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
APRIL 28, 1982

Mr. Chairman and Members of the Committee:

I sincerely appreciate the opportunity to testify before you today concerning the National Airspace System Plan.

The National Association of Flight Standards Employees (NAFSE) is an independent labor union that represents the employees of the Federal Aviation Administration's Flight Standards National Field Office (FSNFO). A summary of the job functions performed by our members is contained in Attachment 1.

I am testifying before this subcommittee because of my great concern for the future of the National Airspace System. I fear that the 20 year plan being put forth by the FAA may compromise the safety and reliability of navigational facilities and instrument procedures that enable the System to function.

FAA Administrator Helms testified before the House Committee on Public Works and Transportation, Subcommittee on Aviation, that "Adoption of automated techniques [of flight inspection]... will cut the number of flight hours by more than 60% by the year 2000 saving at least 5 million gallons of fuel each year." I must tell you that we have been using "automated techniques" since

1975 when the current flight inspection aircraft were phased into use. Some reduction in flight hours was attributable to automated techniques, but a greater reduction was possible because of increased aircraft speed which saved enroute (deadhead) time between inspection sites. The claim by the Administrator that he can save 5 million gallons of fuel each year is preposterous. The FSNFO function used about 6.5 million gallons of fuel in FY 1981. Five million gallons would represent a savings of about 75%. Automated techniques may improve the quality of the flight inspection product, but they will not save 5 million gallons of fuel each year.

The Administrator stated that, "Fleet conversion to turbo-prop [aircraft] provides fuel and flight time savings with a payback (crossover point) of 4 years." We believe this subcommittee should realize that almost 30% of the flight time is spent in deadheading from one location to another. In 1981 this would have accounted for 8,000 of the 27,000 total flight hours. The current jet aircraft in use cruises at 360-440 knots. Most turbo-props cruise at 220-250 knots, which is only 60% of the speed of our current aircraft. This factor alone would increase current flight times by 3,200 hours per year. The Administrator's unilateral decision to consolidate Flight Inspection Field Offices from 7 to 5 would further increase enroute flight time and negate any savings derived from turbo-prop conversion. NAFSE believes the Congress and the aviation public are not being told all the facts by the FAA.

The FAA has proposed budget amounts totaling $122 million for FY 1983-1985 to cover the cost of fleet conversion. The Agency itself stated that the current fleet of flight inspection aircraft could be retrofitted with fuel efficient engines and wing, and the airframe life extended beyond the approaching 10,000 hour limit for about $39.6 million. It appears that retrofit would be far more desirable than phasing in new aircraft, equipment, and techniques. Our organization went through a transition only 5 years ago when we consolidated from 16 to 7 field offices, replaced 44 DC-3s with 20 new jet aircraft with sophisticated avionics, and implemented automated flight inspection techniques.

We witnessed employee morale being devastated beyond belief while the FAA "got the job done" at the expense of its people. It was this period that gave birth to NAFSE. The people had a desire to let their needs be known. (See Attachment 2) We do not want to see the same mistakes made during this next transition period starting in FY 1983. It is obvious to us that a slower aircraft utilizing the same automated techniques will not reduce flight hours. We question whether a small turbo-prop aircraft can withstand the 800-1200 hours per year usage of flight inspection,without escalating aircraft maintenance costs, to the point where the advantages of its fuel efficiency are outweighed by operational inefficiency. We can only surmise that flight hour reductions listed in the FAA Plan are based mainly on reducing the frequency of inspection for navigational aids.

Mr. Helms' main premise for aircraft flight hour reduction is based on the new use of solid state navigational systems. In fact these solid state systems have been slowly replacing vacuum tube systems for the last 12 years. Flight inspection, whose job it is to check the accuracy and stability of these systems, has found little difference between the dependability of the vacuum tube system and the new solid state systems. A review of an average month's records from three different Flight Inspection Field Offices indicate 30 possibly hazardous conditions. All of these were found on different components of the Instrument Landing System (ILS), the most widely used precision landing aid. Seventeen of these discrepancies, or 57%, were found on solid state equipment. This comparability study clearly indicates that solid state system, while more compact and better engineered, are NO MORE RELIABLE than the vacuum tube systems. Therefore, Mr. Helms projected flight hour reduction is not only FALLACIOUS, but DANGEROUS.

The FAA plans to retain the ILS at 827 locations until 1995. It would seem necessary that flight inspection of these systems would continue through 1995. ILS alone accounted for 11,121 hours of flight time in FY 1981.

The Microwave Landing System (MLS) is to be installed beginning in FY 1985 with 1,255 to be operating by the year 2000. These will require flight inspection services when installed and periodically thereafter. We are amazed that flight inspection hours can be programmed for this new system before reliability of the MLS is even established. There are no criteria or procedures in existence for this system, but if the present day Interim Standard Microwave Landing System is any indication of reliability, there will be little flight hour savings with the new MLS.

Nine hundred VORTACS are scheduled to be upgraded with solid state equipment. Flight Inspection requirements for these conversions have not been solidified. However, there is a test program to check 10 existing VORTAC's "before and after" the conversion to determine the flight hour requirements for this program. What concerns us is that it appears the flight hour reductions proposed in the National Airspace System plan anticipate no need for flight checking these facilities as they are converted.

We are deeply concerned that the Agency who held $57 million in reserve to reward one segment of its workforce, while issuing letters of proposed 12 day furloughs to others, is again showing Congress only one side of the ledger sheet. This is the same Agency who's employees made many personal sacrifices during the weeks and months following the Air Traffic strike. It concerns us that the FSNFO (a 600 employee segment of the FAA) used 13,144 hours of overtime in FY 1981 to accomplish its routine functions and, now, the FAA proposes to further reduce its workforce by 52 positions through reduction-in-force action. (See Attachment 3)

We wonder how it is that the FAA can reduce flight hours and cost with a slower aircraft, increased workload, and office consolidations without compromising the integrity of the National Airspace System.

We ask that this subcommittee consider the views of our organization in reviewing technological plans and decisions made by the FAA. We ask that the Congress and people of the United States be given a safe, cost effective National Airspace System by providing the FAA with the proper funding, and time, to prove reliability of its new and yet untested maintenance and inspection systems.

Thank you for allowing us to present our views on the National Airspace System Plan.

Attachment 1

FSNFO

The Flight Standards National Field Office (FSNFO) is responsible for conducting the world-wide flight inspection program. Flight crews operating from ten field offices strategically located throughout the United States and abroad, perform flight inspections of air navigation facilities using specially equipped aircraft capable of being electronically preprogrammed for computer reduction and analysis of facility performance. The field offices are responsible for developing instrument flight procedures for use in the National Airspace System (NAS) and for assuring that these procedures are safe and practical. Aircraft maintenance bases at each office perform various levels of aircraft and avionics line maintenance on the sophisticated flight inspection aircraft.

The FSNFO's other mission is to support the national program functions of the Washington headquarters by carrying out projects and research, managing national safety data systems, developing airman written examinations, performing special engineering studies, conducting pilot and airworthiness examiner standardization courses, and preparing a wide range of technical reports and publications.

Attachment 2

Transition to Jets and Automated Techniques

The transition actually began in 1974 with the closing of flight inspection offices in preparation for receiving the new aircraft with the "Automatic Flight Inspection System." From 1975 to 1978 flight crews and maintenance personnel were given limited training on the new equipment and techniques. The equipment had not been thoroughly field tested by the FAA in insure that the automated techniques would work. In theory and on paper it looked good, but in the real world environment there were many problems, problems that are just now being resolved in 1982, seven years after implementation was started.

The concept used to sell that new program was based partially on the idea that flight crews would follow a rigid schedule as they worked their way across the country doing routine work, and if a problem was discovered with a facility, a more efficient aircraft would be sent in to restore the facility to service. This concept would not work. Flight inspection is a "stop and fix" organization, and it is this concept that best serves to maintain the excellent safety record of the NAS.

The transition period was utter turmoil. Staffing and offices had been cut to levels that would be needed with the automated jet aircraft, and the seven offices now had jets and flight inspection equipment that were not ready for field use. Aircraft utilization rates were low because of hardware and software probelms. Offices were expected to fly and maintain the antique DC-3 flight inspection aircraft in order to get the workload accomplished, and they were not staffed for the number of aircraft they had.

Experienced, highly skilled employees became disgusted with management attitudes towards human resources. These experienced people retired or left the FAA, leaving a severe void of technical skill. New employees were hired, given minimal formal training, and were sent out to the field to assist in performing critical functions of positioning an aircraft, programming the computer, or analyzing collected technical data. There was no formal on-the-job training program for these new employees, and they were left to learn on a "catch as catch can" basis, a most inefficient way to train people. In 1978-1979, a detailed "Job Task Analysis" was conducted for Flight Crew positions at a contract cost of $104,000. This study was to enable the FAA to develop a structured, well organized training program for its flight crews. To date there is no formal OJT program. We must question whether an organization such as this could bear the expense of another transition period.

Attachment 3

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FLIGHT STANDARDS NATIONAL FIELD OFFICE
P.O. BOX 25082
OKLAHOMA CITY, OKLAHOMA 73125

APR 12 1982

James G. Duea
President, National Association of
Flight Standards Employees
20960 Putting Avenue
Hastings, Minnesota 55033

Dear Mr. Duea:

The following information is provided in accordance with Article 18 of the National Association of Flight Standards Employees/Flight Standards National Field Office agreement.

The Flight Standards National Field Office will be reducing 52 positions and plans to fill the 21 positions listed on the enclosure. However, additional reductions, or field office consolidations, will probably result in changes to this list.

Sincerely,

Robert L. Goodrich

Robert L. Goodrich
Chief, Flight Standards National
Field Office

Enclosure

VACANT POSITIONS

1.	AFO-501	Assistant Chief, FSNFO	GS-301/15
2.	AFO-511	S Aero Eng	GS-861/14
3.	AFO-540	Program Manager	GS-340/15
4.	AFO-540	Secy Steno	GS-318/05
5.	SEA Office of Mgr	Secy Steno	GS-318/06
6.	SEA LM	Mech	WG-8852/11
7.	SEA LM	Avionics Tech	GS-856/11
8.	LAX LM	Mech	WG-8852/11
9.	LAX LM	Mech	WG-8852/11
10.	LAX Proc	ASIP	GS-2181/13
11.	BTL LM	Mech	WG-8852/11
12.	BTL LM	Avionics Tech	GS-856/11
13.	BTL LM	Avionics Tech	GS-856/11
14.	MSP Proc	ASIP	GS-2181/13
15.	ATL	Manager	GS-340/15
16.	ATL LM	SET (Avionics)	GS-856/12
17.	FRA	Secy Steno (When Griffin leaves)	GS-318/06
18.	FRA LM	Avionics Tech	GS-856/11
19.	HNL LM	Avionics Tech	GS-856/11
20.	TYO FI	ASIP	GS-2181/13
21.	TYO FI	SET	GS-856/13